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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF SECRETARY, 26 CENTRAL SQUARE,
EAST BOSTON, MASS., Feb. 8, 1907.

To the Members of the New England Association of Gas Engineers—Gentlemen: The Thirty-seventh Annual Meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, Wednesday and Thursday, February 20th and 21st, 1907. The following papers and topics are to be presented:

"The Present and Growing Need of a Uniform System of Accounts," by Mr. Alex. C. Humpreys, President Stevens Institute.

"Some Commercial Departments in the West," by Mr. E. N. Wrightington, Secretary Boston Consolidated Gas Company.

"Methods of Removing Naphthaline from a 16-Inch Pipe," by Mr. D. T. Burritt, Superintendent Springfield Gas Light Company.

"The Process of Making Incandescent Gas Mantles," by Mr. M. C. Whittaker, Superintendent Welsbach Company, Gloucester, N. J.

"Diagram of Changes in Output, 1890 to 1905," by Mr. S. J. Fowler, Manager Charlestown Gas and Electric Company.

"Some Instances of School Room Lighting," by Mr. N. W. Gifford, East Boston.

"Temperature and Manipulation of Condensing Apparatus," by Members.

Question Box.—What is the function of a hot scrubber? Would such a piece of apparatus be necessary when the condensers exerted a scrubbing as well as a cooling effect on the gas in water gas manufacture? Would such a combined scrubber and condenser more seriously affect the candle power than the usual arrangement?

The most economical way of enriching coal gas?

Is there any successful device for giving a continuous record of CO_2 in water gas manufacture?

In upper connections between generator and carbonator is a dry valve better than one water cooled?

Is it necessary to have a scrubber in water gas manufacture?

Where is the best place to locate a P. & A. condenser in water gas making?

In coal gas making what harm does high temperature on the P. & A. condenser?

All friends of the Association are welcome to its sessions without a formal invitation. The library of the Association is at 715 Tremont Temple. The annual dinner will be held Wednesday evening at 6:30 P. M. Application blanks for membership can be had upon request, from the Secretary. Members having subjects for the Question Box will please send them to the Secretary at their earliest convenience.

N. W. GIFFORD, Secretary.

BRIEFLY TOLD.

THE NEXT MEETING OF THE ILLINOIS GAS ASSOCIATION.—Mr. J. M. Robb, the efficient and persuasive gentleman who serves the Illinois Gas Association as its Secretary, is out with a well framed circular-letter respecting the next meeting of the Association, which is to be held in Peoria, Ills., beginning the 20th prox. Here are the circular's hintings anent the meeting, for it looks best to print them as they are, rather than to garble them by attempting a condensing thereof:

The Illinois Gas Association meets in Peoria, March 20–21, 1907. Make your arrangements now to be there. Here is the paper list. Did you ever see one that promised better?

"Coal Fuel for Firing Gas Benches," by Mr. W. R. Rhoades, Springfield.

"New Business Methods," by Mr. A. D. Mackie, Springfield-Peoria.

"Operation of an Ideal Shop," by Mr. C. B. Strohn, Elgin.

"The Best Methods of Operating Water Gas Machines," by Mr. W. I. Battin, Chicago.

There will also be a general discussion of conditions affecting the gas business in Illinois. To promote this discussion the attached tables have been compiled from data reported for our Directory. Please note them, mark your Company's standing and be prepared for a part in the discussion. If your Company's results are among the best, you may be able to assist some less fortunate neighbor. If your Company is not doing as well as some of the others, you can probably learn how to better your results.

There is no good reason why Michigan towns, as a rule, should sell

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more gas than Illinois towns. Yet if you will consult your Directory, you will find this to be the case. It would seem that the same kind of energy applied to the gas business in Illinois should produce as good results as similar energy expended in Michigan. Don't you think so? If you do not, tell us why at the Peoria meeting.

If Company 56 (see Table 3) can send out 6,250 cubic feet per capita per annum, why can't the 19 companies that show less than 2,000 cubic feet, do better?

If Company 12 (see Table 4) can send out 3,000,000 cubic feet annually per mile of main, why isn't it possible for those companies sending out less than one million to do better than they are now doing?

What makes it impossible, if it is really so, for so many companies to send out more than 24,000 cubic feet per meter when Company 10 (see Table 5) sends out 37,500 cubic feet per meter per year?

No improvement is possible, unless we gas men keep continually asking the question "Why?" and then earnestly and persistently endeavoring to answer it.

Are you coming along with us? If you have not yet sent in your application for membership, *do it now.*

The Illinois Gas Association maintains an Information Bureau for its members. That alone is worth more to you than the very small annual dues.

The Tables referred to by Secretary Robb accompany his circular letter, and as we are not sure the Association would give its consent to their public reprinting, it is enough to say here that he will be glad to furnish them to any member on application to him at his office in Peoria, Ills.

PRESIDENT CLARK'S ADDRESS.—Elsewhere we reproduce in full the excellent address to the National Commercial Gas Association at the January meeting, by its President, Mr. William J. Clark, of New York. Those who know that gentleman completely know that he is in every sense a master of the branch of the craft to which he belongs; for one who has studied the commercial end of the gas business in the largest city of the States, knows that here is perplexity of the greatest sort found (without looking for it either) in exceeding plenty. However, Mr. Clark has not been daunted, and much of his victory in the premises is due to natural smoothness, that has been so patiently cultivated as to have attained nothing short of that which our denizens of la belle France so happily name *finesse.* You do not find Mr. Clark hinting to Chief Bradley or suggesting to Deputy Bruce that the plan of constructing the Consolidated Company's great plant might be modified or bettered by this, that or any means; nor do we find him hinting to Division Engineer George E. Woods that gas, if made on ever so slightly different lines from those now in force, could be better or more successfully put into the holders and mains; nor even is he discovered informing Division Engineer A. M. Smith that the general main system of the Company might be improved if such a course were adopted. Not at all. He is at his part of the task with only the simple demand going out constantly, "Give us the gas; we will do our best to sell it." In entire harmony with the engineering force, they work in harmony, in unison, and with success. No person engaged in the commercial section of the gas industry can fail to read this address without benefit to himself or without profit to his company, and many times its paragraphs will be studied for good by the commercial gas man who wishes to go ahead in his branch of the trading, be he located in Amarillo, Tex., or in New York itself.

CURRENT COMMENT.—

THE proprietors of the Green Fuel Economizer Company have arranged for the building of an addition to the fan shop of the Green Fuel Economizer Company's handsome factory and shop at Matteawan, N. Y. The Company has recently been put to its utmost to keep abreast of its orders in its fan division and this extension will enable it to more than double the present output. A shop has also been put up exclusively for manufacturing the new patented Green steam and hot water heating coil. The pressure of business in these lines, and in the manufacture of fuel economizers as well, has compelled the Green Fuel Economizer Company to acquire for building purposes several acres of land adjacent to its present property.

THE return made by the Providence (R. I.) Gas Company to the City Treasurer, respecting the operation of the provisions of the franchise agreement between it and the city, shows that the gross earnings for the quarter ended December 31st last, amounted to $254,260, and the tax on such sales to be covered into the city treasury amounts to $7,627.64. For the corresponding period of 1906 the respective sums were: $241,960 and $7,259.

[Continued from Page 185.]

Report of Committee on Electrolysis, Prepared for the American Gas Light Association, and Submitted to the American Gas Institute on Behalf of the Former as a Contribution to the Proceedings of the Latter.[1]

Electrical Developments on the Steam Railroads Entering New York City.—The New York Central Railroad decided several years ago to change its motive power from steam to electricity within the limits of the city of New York and for some distance beyond this limit. This electrification will extend from the Grand Central Station to White Plains on the Harlem Division and to Croton on the Hudson River Division, and will comprise about 300 miles of single track. The work was begun in 1903 and is to be completed in 1908.

Direct current at 600 volts will be used for operating the electric locomotives and motor cars which have been especially designed for this work. These electric locomotives are planned to develop 2,200-horse power at their normal rating and to have a maximum capacity of 2,800-horse power. At the 600 volts pressure used these powers represent about 3,060 and 4,000 amperes respectively.

The electric power is to be generated as 3-phase alternating currents in 2 main power stations and is to be distributed from 8 sub-stations as direct current. The total capacity of the 2 power stations combined is to be 40,000 kilowatts, with provisions for an ultimate increase of 60,000 kilowatts. A third rail will be used for the positive working conductor, augmented by large auxiliary copper feeders. The service rails, together with copper cables when necessary, will be used for the return circuit.

The New York, New Haven and Hartford Railroad Company is electrifying a part of its system leading out from New York city, and has adopted single phase alternating current for its motive power. Since, however, it uses the Grand Central Station, in common with the New York Central Railroad, for its New York terminal, its motor equipment has been designed to operate also on the direct current supply of the latter road, where the common tracks are used. The outcome of this new development will be of great interest.

The Pennsylvania Railroad is also building a large terminal station in the heart of New York city, with tunnels extending completely across the city, and under the 2 rivers, connecting its lines in New Jersey and Long Island. Direct current at 650 volts will be used for the entire terminal service. The current distributing system to the trains will be similar to that of the New York Central railroad, namely, a third rail for one conductor and the service rails for the return conductor, augmented by copper feeder cables. Very large amounts of current will be required for this service.

ELECTROLYTIC CONDITIONS IN NEW YORK CITY.

The electric railways which were operated on Manhattan Island before 1903 were all double trolley conduit roads, which do not give rise to stray currents, and therefore do not form a source of danger to underground metals. Hence, notwithstanding the enormous amount of current used for electric traction in Manhattan, there has been practical immunity in the past from electrolytic damage.

The Manhattan Elevated Railway has been using a grounded return system only since 1903, and the Subway was opened in 1905, and no experience with electrolysis due to stray currents from these systems has yet been made public.

The following statement, however, was made by Prof. George F. Sever, before the International Electrical Congress, St. Louis, 1904:

"The Manhattan Elevated Road uses its structure completely bonded, its service rails completely bonded, and a large amount of return feeder, something like 6 or 7 million cir. mils, to get its current back without causing trouble to its own and other conductors. In spite of all these precautions there are still thousands of amperes coming back on its cable sheaths as well as those of other companies. It has been drawn to the attention of the city officials for their recommendation, as there is at times a higher potential than 25 volts between the end of the line and the nearest sub-station, which is the maximum fixed by the city rules."

It may be stated at this point that the only regulation in force in the city of New York for the protection of underground metals from electrolysis is the following *worthless* provision, which is taken from the "Rules and Regulations" of the "Department of Water Supply, Gas and Electricity" for 1904:

"For the diminution of electrolytic corrosion of underground metal

1. This report is limited to the consideration of direct current electricity, and is, therefore, contingent upon future developments in the use of alternating current electricity for traction purposes.

work, ground return wires must be so arranged that the difference of potential between the grounded dynamo terminal and any point on the return circuit will not exceed 25 *volts*" [!]

In the Bronx and the adjoining territory, where the single trolley and grounded rail return are used, considerable difficulty from electrolysis has been experienced. Mr. A. A. Knudson reported the results of an electrolytic survey, which he made in New York city, in a paper read before the American Institute of Electrical Engineers, October, 1898. In this paper, Mr. Knudson states that he found considerable current in the gas and water pipes in the section of New York above the Harlem river, and gives the results of a great many voltage measurements between the rails and the sewer pipes, the gas pipes and the pillars of the elevated structure. He also states that in one location, where the rails are positive to the pipes, the bottoms of the rails were in some cases so badly corroded that, for several feet back from the ends, these bottoms were cut down to knife edges; the tie rods which keep the rails in position were also found so eaten away that the middle portion was missing.

In Brooklyn, where the single trolley with grounded rail return is also used, considerable trouble from electrolysis has been experienced. The stray currents from the Brooklyn system have even found their way into the pipes of Manhattan Island by way of the Brooklyn Bridge and the East river. A number of tests in this connection were made in Brooklyn and in Manhattan, by Mr. A. A. Knudson, and some of these are recorded in a paper on the "Corrosion of Metals by Electrolysis," which is published in Vol, 3, 1903, of the Transactions of the American Electro-Chemical Society. The following is an abstract of a part of this paper:

It has been known for some years that pipes in the Brooklyn Navy Yard have been destroyed from time to time by electrolysis. The potential difference between points on the sides of the Yard near Flushing avenue and Navy street, and a point nearest the power station, have been found to be from 20 to 25 volts. The railway company suggested that the damage caused to the underground pipes was not due to its currents, but was caused by the Navy Yard's own electric light and power circuits. The question remained uncertain until the day of the late President McKinley's funeral, when the Kent avenue power station, as well as all others in the country, closed down for 5 minutes. It occurred to some of the engineers of the yard that it would be a good plan to make a few tests at that time, and this was done while the lighting and power circuits were running and the railway power station closed down. It was found that the voltmeter needles remained at zero at every test that was made, proving conclusively that the currents causing the damage emanated from the railway power station.

Several water and gas mains have burst in Brooklyn, owing to electrolysis. The following are a few instances: On July 14th, 1899, an 8-inch water main burst in Flushing avenue near Classon avenue. All the characteristics of electrolysis were found upon this section of pipe, viz., the soft state of the iron in several places which was reduced to a condition of graphite, easily shaved with a pocket knife. The voltmeter readings showed it positive to the rails, and it was also in wet soil. This pipe was of th e Scotch iron make. Subsequently to the bursting of this main at this point, there have been 3 other failures upon the same pipe in this street within short distances of each other.

The next is a 6-inch pipe, and represents a clear case of electrolysis. This was taken from Wallabout place near Washington avenue, a short distance from the canal. This pipe was positive to rails on Washington avenue, positive to canal, and positive to gas mains in the same street. The highest reading found was 5.9 volts positive to rails.

A few years ago an impression prevailed that underground mains in Brooklyn were immune from electrolysis, and it was thought that there was something about the Scotch iron mains which resisted electrolytic action. The theory was advanced that a thin, "silicious compound" was formed over the surface of the Scotch pipes in the process of casting, and that this material insulated the pipes and made them immune to electrolysis. In view of the fact that many failures of pipes in Brooklyn have occurred since 1899, due to electrolysis, it is clear that the above reasons as to immunity will not stand.

In a discussion of electrolysis, before the International Electrical Congress, St. Louis, 1904, Mr. Bancroft Gherardi, Chief Engineer of the N. Y. and N. J. Telephone Company, made the following statement:

"One of the functions of my department is taking precautions against electrolysis trouble on our cables, and in that connection the bulk of our work has been in Brooklyn, on account of our very large underground plant there and the great extent of the overhead trolley system. It is not unusual for us to have to take care of currents as great as 200 or 300 amperes at a single point on our system. This shows that the aggregate amount of currents that our system is carrying back to the power houses amounts to thousands of amperes. There is a certain expense in connection with this work which is quite appreciable, and there still remains, after everyting is done that we can do, a certain amount of trouble which is real trouble. The discussion of the responsibility for such trouble and expense is one that it seems to me is beyond the scope of this section, and I shall not touch on it here."

The New England Water Works Association, December, 1905, held a "Topical Discussion on Electrolysis," and the following are some remarks made at this discussion by Mr. Wm. E. Foss, Division Engineer of the Metropolitan Water Works, Boston:

"Mr. President and Gentlemen—These specimens that Mr. Brooks has thoughtfully brought here for our inspection direct our attention to the difficulty of detecting injury to cast iron pipes from electrolysis by a visual inspection only. It is usually easy to see the effects of electrolysis on a lead, steel or wrought iron pipe from a rather careless examination, but the injury is found on the cast iron pipes only by a very careful examination with a testing hammer or a knife. If the pipe is of lead, steel or wrought iron the metal is usually completely eaten away, leaving a visible pit or hole, but if of cast iron, the iron is removed without destroying the form of the pipe, which remains perfect, although the remaining substance is a soft material, like carbon, which can be easily cut with a knife or chipped with a testing hammer.

"A while ago I had occasion to examine a 48-inch pipe line for electrolytic injury, and was unexpectedly detained at the office until after the workmen had completed the excavation. As I did not appear at the appointed time the foreman examined the pipe and telephoned to me, reporting that he had looked the pipe over very carefully and found it as good as new, with no evidence of any injury. He was directed to keep the excavation open, and when a careful inspection of the pipe was made with a testing hammer a large number of deep pits were found in it.

"An interesting feature in connection with electrolysis is that no way has yet been discovered to entirely prevent the action where the single trolley electric railway is in operation, although investigations of the process have been made during the past 10 or 15 years.

"Fairly good results have been obtained by bonding telephone cable sheaths to the rails or return wires to protect them. A complete knowledge of the electrical conditions existing at the time the bonds are connected is necessary in order to properly locate them, and continual inspections are necessary after they are connected to detect the continually occurring changes in electrical conditions as soon as they take place, so that the necessary relocation of the bonds may be made. An objection to this method of protection is that it causes increased action on the other structures buried near the cables. An example of the damage caused in this way is given in the photograph, Plate II. [not reproduced here], which shows a 6-inch hydrant pipe which burst while the hydrant was in use during the fire that destroyed the Academy of Music in Chelsea, January 11, 1905. This break was due to the disintegration of the iron by electrolysis at the point where it crossed under a telephone cable which had been bonded to the railway return for protection.

"After bonding, the cable is actually a portion of the street railway return system, and on account of being buried several feet below the surface in the damp ground near other structures is more likely to cause electrolysis than a rail located on the surface. As much as 500 to 700 amperes is drained from the cables over some of the bonds.

"Attempts have been made in a few places to protect the water and gas pipes from electrolysis by bonding them to the rails, but the results have not been entirely satisfactory. In 2 cities, where the pipes were bonded to the rails about 10 years ago, the pipes have remained positive to the rails in some districts, the injury to service pipes has continued, and it has recently been necessary to employ experts to investigate the electrical conditions in both places. In one of the cities some of the bonds were located in the negative districts and delivered electricity to the pipes instead of draining off that already on the pipes as intended. The result of making the pipe system a part of the electric railway return system has been to cause enormous currents to flow over some of the pipes. It has been reported that over 3,000 amperes is flowing on a 12-inch gas pipe in one of the cities, and that the pipe is perceptibly warmed by the current.

"It is a much more difficult problem to protect a pipe system than it is to protect a telephone system by bonding, on account of its interwoven network of mains and services, large extent, large surface contact with the earth, and uncertain joint resistances. To attempt to protect all of the underground structures by bonding would necessitate the

bonding of all of the structures, and of the adjacent parts of each structure together at many points, and the draining of the entire structure to the railway return through a booster. That is, to completely protect the structures by this method each structure must be made negative to every other structure, which is evidently impossible. The nearest we could approach to this condition is to maintain all the structures at the same potential, and this is practically impossible."

The American Water Works Association unanimously adopted, in 1901, the following Report of Special Committee on Electrolysis:

"Your Special Committee on Electrolysis, appointed to make recommendations for the guidance of the Association in dealing with the problem, and to formulate, for your approval, an expression of the attitude of the Association on this question, respectfully begs to submit herewith its report. The following facts are established:

"1. A very large number of mains and service pipes have been already actually destroyed by the stray return currents of electric railways operating under the single trolley system, many instances of such destruction of pipes by these currents having been reported from practically every city where the single trolley system has been in use for any considerable length of time. Even where the action is too slow to be immediately discovered, the life of the mains and service pipes is inevitably greatly shortened and their value thereby necessarily proportionately decreased.

"2. In the single trolley system, no matter how large the capacity of the return feeders, nor how good the bonding of the rails, and even when the continuous rail is used, some electric current will, under the law of divided circuits, flow along the water pipes, the amount of this current bearing the same proportion to the total current used, that the conductivity of the return path of which the water pipes form a part bears to the total conductivity of all the return paths offered to the current. As neither the rails nor the pipes can practically be insulated from the soil in which they are laid, the proportion of current conveyed by the pipes is considerable, even with the best track bondage known to modern science, including the welded joint.

"3. The electric current, once on the pipes, must leave them to return to its source, the generator, and wherever the current leaves the pipes to pass through the soil, the p pes are damaged.

"4. Electrolysis also results from differences in potential between water pipes and any other underground metal conductor such as gas pipes, and as long as the return current is not entirely removed from the earth, such action will continue.

"5. The extent of the electrolytic injury at any point is directly proportionate to the number of amperes of current leaving the pipe. The smallest measurable difference of potential is sufficient to produce electrolysis.

"6. A cast iron water main is not a continuous electric conductor, and its joints offer very much higher resistance than an equal length of the plain pipe.

"7. The inevitable effect of any resistance at the joints is to cause a part of the current carried on the pipes to be shunted around the joint, either through the soil on the outside or through the water on the inside, or by both paths.

"8. Wherever the current leaves the pipe to pass around the joint, either outside or inside, or both, the pipe is injured. The action of a fraction of an ampere flowing around successive joints will in time do great aggregate damage to any cast iron main on which it flows.

"Your Committee is convinced, after careful consideration of reliable data on the subject, that there is no known practical method by which owners of underground pipes can protect them against electrolytic injury from single trolley currents, but that there are two methods of operating electric railways by which the return currents can be kept out of the ground; namely, the conduit system, as in use in New York city and in Washington, D. C., and the double, overhead trolley system, as operated in Cincinnati, O., and on suburban lines in the District of Columbia.

"The conduit system is more expensive to construct, and is peculiarly adapted to the larger cities. The first cost of installing a double trolley system would be a little greater than that of a single trolley system for the same service; while the cost of converting an existing single trolley system to a double trolley system would be trifling, as compared with the enormous interests endangered by the single trolley current.

"Ten years' experience with the double trolley in Cincinnati proves that that system is entirely practical, possesses many advantages over the single trolley, is more economical in operation and maintenance, and that it completely stops the injury to the pipes.

"Your Committee, therefore, respectfully makes the following recommendations:

"1. Street railway companies should be compelled, as are electric light companies, and all other electric power companies, to provide a complete melallic circuit for their current, absolutely insulated from the rails and ground. This will keep the return currents out of the ground and off the pipes, and can be accomplished either by the conduit system or by the double, overhead trolley system.

"2. No connections by which a current is carried to the pipe, or induced to flow thereon, should be allowed from pipes to rails, or to other return conductors; and no other alleged remedy which permits the mains to carry any portion of the return current should be countenanced by those in charge of water works plants. Even the failure to prohibit or to protest against such connections might be construed by law to be a tacit consent on the part of the water works management to the use of the pipes as conductors, and might relieve the electric railway company from responsibility for the injury which would inevitably result if the mains were allowed to convey current.

"In the further discharge of the duties for which it was appointed, your Committee respectfully submits for your approval the following preamble and resolutions, as an expression of the attitude of this Association on the question of electrolysis:

"*Whereas*, The report of the Special Committee on Electrolysis shows that, wherever the single trolley system is in use, a portion of the return electric current will flow on the water pipes, and that whenever water pipes become positive to rails or gas pipes or other underground metal structures, the water pipes are injured; and that whenever water mains, whether positive or negative to the rails, convey electric current, they are liable to injury thereby, near the joints; and

"*Whereas*, It further appears from the said report that there is no known practical method by which owners of water pipes can protect themselves against electrolytic injury resulting from the operation of single trolley cars, but that electric railways may, by means of the conduit system or of the double, overhead trolley system, be operated successfully and economically and without any injury to the water pipes; now, therefore, be it

"*Resolved*, That the American Water Works Association, as a national organization, herewith unanimously maintains that street railways have no right to so operate their cars as to cause injury and destruction to water pipes; and, be it further

"*Resolved*, That street railways now operating under the single trolley system ought to be required to remove their return current from the ground, and that if they continue to operate by current transmitted from the power station to motors on the cars, they should be required to provide a complete metallic circuit of sufficient capacity to convey all the current, and in a manner absolutely to insulate it from the rails and from the earth."

D. H Maury, G H. Benzenburg, J. W. Smith. } Special Committee on Electrolysis.

SECTION III.

Electrolysis in Great Britain.

It may facilitate the endavor to apply British experience to American conditions, if this Section be prefaced with a brief description of the connection between the National Government and municipal and public undertakings in the United Kingdom. Great Britain has, what may be called a central financial government of public utilities. The broad financial control of all municipal and public undertakings centers in Parliament. Parliament holds the general purse strings, not only of the Nation, but also of the local authorities, and of all public franchise undertakers throughout the United Kingdom.

What are known in America as public franchises, are generally described in Great Britain as "Parliamentary powers;" and the right to grant such powers or franchises is vested solely in Parliament. British municipalities cannot grant such public rights to others, nor can they even supply themselves with gas, water, electricity, or similar public necessities or conveniences, without Parliamentary sanction. Theoretically, a British municipality is on precisely the same basis with a private citizen when seeking Parliamentary powers for public service undertakings.

This Parliamentary control over municipal and public undertakings is exercised both through direct Acts of Parliament and through the medium of the Departments of State known, respectively, as the Board of Trade and the Local Government Board, the Presidents of which are Cabinet Ministers. In general, the British system operates as follows:

A municipality, or an association of individuals, applies to Parliament for power (for instance) to construct and operate an electric tramway in specified thoroughfares. If this application has been legally advertised, so that all affected thereby have received proper notification to enable them to oppose the application, and if all other Standing Orders of Parliament have been duly complied with, the application or bill is admitted to what is called the Committee Stage. Then a Commons' Committee and a Lords' Committee, acting independently, take evidence and hear witnesses and counsel *pro* and *con* the bill, which must be approved by both of these Committees before it is recommended to Parliament for passage.

If the bill passes both Houses and becomes an act, it will *inter alia* fix the amount of money that may be expended under the act, and will place the enterprise under the jurisdiction of the Board of Trade or of the Local Government Board. That is to say, Parliament delegates cer-

tain regulative powers to one or both of these two departments of State until the expenditure authorized has been exhausted. It is then necessary for the undertaking to seek further Parliamentary power to raise new capital for the prosecution of the enterprise. Upon each such occasion, Parliamentary Committees, with the aid of the Board of Trade and the Local Government Board, investigate the manner in which the undertaking has fulfilled its responsibilities, and hear witnesses and counsel *pro* and *con* the new application. It is the practice of Parliament to restrict the financial powers granted upon any one occasion so that public service undertakers must reappear before Parliament, at reasonably frequent intervals, to demonstrate that they are using their privileges fairly in the interests of both public and shareholders, and to insure that the degree of supervision delegated to the Board of Trade and to the Local Government Board, during the interregnum, is effective and sufficient.

General electric lighting acts were enacted by Parliament, in 1882 and 1888, and in 1899 there was enacted a further general Electric Lighting (Clauses) Act "incorporating in one act certain provisions usually contained in Provisional Orders made under the (previous) acts relating to electric lighting." Section 77 of this 1899 act is as follows:

"The Undertakers shall be answerable for all accidents, damages, and injuries happening through the act or default of the Undertakers, or of any person in their employment by reason of or in consequence of any of the Undertakers' work, and shall save harmless all authorities, bodies, and persons by whom any street is repairable, and all other authorities, companies, and bodies collectively and individually, and their officers and servants, from all damages and costs in respect of those accidents, damages and injuries."

Gas, water, telephone, railway signal and other affected interests, feel and are sufficiently safeguarded by the above broad protective clause, in so far as electric lighting undertakings are concerned; and, on the other hand, this clause is considered practicable by the electric lighting undertakings, who are willing to conduct their operations subject thereto. The fact that this mutually satisfactory basis has been so readily reached between the electric lighting interests and the other statutory undertakings, is due to the invariable use in electric lighting of insulated metallic returns. But when we come to the question of tramways or other undertakings using large currents of electricity with uninsulated returns, or even with the earth as a return, a new condition is presented which requires special protective measures; and it is this phase of the problem with which we are now concerned.

Owing to complaints of telephonic and other electrical disturbances, and to apprehension regarding the destructive effect of electrolysis upon gas and water mains following the extensive introduction of electric tramways, a Joint Committee of Lords and Commons was appointed in 1893

"To consider and report whether the grant of statutory powers to use electricity ought to be qualified by any prohibition or restriction as to earth return circuits, or by any provisions as to leakage, induction, or similar matters; and, if so, in what cases and under what conditions. And, if the Joint Committee is of opinion that any such prohibition, restriction or provision should be enforced, to settle the necessary clauses."

The report of this Joint Committee, together with the proceedings, minutes of evidence, etc., extending to some 300 pages of closely printed foolscap,[1] was submitted July 13th, 1893. The report proper is appended to this statement, and is marked *Exhibit A.*

The next governmental step in the general control of electric tramways was the establishment by the Board of Trade of general tramway regulations giving effect to the recommendations of the Joint Committee. These Board of Trade Regulations are appended to this statement, and marked *Exhibit B.*

The third and final *general* step in the Parliamentary control of electric tramways was the drafting of a model tramways bill. This model bill, as its name implies, is merely an official pattern drafted for the guidance of committees and promoters. It contains the various standard clauses framed to give the proper legal effect, when incorporated in specific bills, to the general acts and regulations defining and restricting the Parliamentary powers conferred upon electric tramway undertakings.

As this model bill epitomizes authoritatively the general privileges as well as the general responsibilities of British electric tramway undertakings, it is appended to this statement, marked *Exhibit C;* and special attention is directed to the sub-division entitled "use of mechanical power." being sections 19–25 inclusive.

We have now traversed the history of Parliamentary general control of electric tramways in the United Kingdom, in so far as damage from electrolysis is concerned.

Firstly; the appointment of a Joint Committee from both Houses of Parliament to consider and report upon the question of protective clauses. (See Exhibit A, and Parliamentary "Blue Book.")

Secondly; the drafting of specific regulations, giving effect to the recommendations of this Committee, by the Department of State (the Board of Trade) responsible for such control of electric tramway undertakings. (See Exhibit B.)

Thirdly; the establishment of a model tramways bill, embodying *inter alia* these Board of Trade Regulations, to which all specific applications for Parliamentary powers to conduct tramway operations must substantially conform, before they can pass the Committees of either House. (See Exhibit C.)

It will be seen, therefore, that Parliament has established a general system governing electric tramways, whereby all other statutory untakings in the United Kingdom receive automatically, as it were, such protection as is afforded by the Board of Trade Regulations. Hence, as far as Great Britain is concerned, the first question is whether these Board of Trade regulations are meant to, and do afford effective protection to gas and other pipes from damage by electrolysis.

Clause (3) of Section 20, model tramway bill (see Exhibit C), says:

"The electrical power shall be used only in accordance with the Board of Trade regulations, and in such regulations provision shall be made *for preventing fusion or injurious electrolytic action of or on gas or water pipes* or other metallic pipes, structures or substances and *for minimizing as far as is reasonably practicable* injurious interference with the electric wires, lines and apparatus of other parties and the currents therein, whether such lines do or do not use the earth as a return."

Parliament has thus expressly instructed the Board of Trade to impose regulations upon electric tramway undertakers "for preventing fusion or injurious electrolytic action of or on gas or water pipes," whereas they are required only *to minimize as far as is reasonably practicable* injurious interference with electric lines and currents.

This discrimination is further brought out in clause (4) which contains no further reference to fusion or electrolysis, but which specifically exempts tramway undertakers from consequences due to electrical *interference*, provided they conform to the Board of Trade regulations. Clause (5) still further emphasizes this discrimination. It is clear, therefore, that Parliament expects the Board of Trade to impose tramway regulations that will give gas and water pipes practical immunity from fusion or electrolysis.

On this expectation that the Board of Trade regulations are (or should be) an effective protection from fusion and electrolytic action, these clauses (3) and (4) are construed to relieve tramway undertakers of all liability for damage due to fusion or electrolysis, as well as to electrical interference, provided their operations are conducted, as they must be, in accordance with these Board of Trade regulations. Therefore, unless negligence be proven, tramway undertakers are not liable at common law for any damage sustained by other statutory undertakings from these causes. In other words, so long as tramway undertakers conform to the Board of Trade regulations, and conduct their operations with reasonable care, they are legally exempted from responsibility for damage by fusion, electrolysis, or electrical interference, consequent upon their operations.

The crux of the Board of Trade regulations is clause 7:

"When the return is partly or entirely uninsulated a continuous record shall be kept by the company of the difference of potential during the working of the tramway between points on the uninsulated return. If at any time such difference of potential between any two points exceeds the limit of 7 volts, the company shall take immediate steps to reduce it below the limit."

As was inevitable, with this permissible potential difference of *seven* volts (the German Electrolysis Commission suggests a present limit of *one* volt), gas and water companies find that these regulations will not and cannot prevent damage from electrolysis.

Hence, the imposition of these regulations has brought exemption to electric tramway undertakings, without bringing immunity to gas undertakings. Gas companies are, therefore, asking whether the cure is not worse than the disease: that is to say, whether the insufficient relief afforded them by the existing Board of Trade regulations justifies the sacrifice of their common law rights to compensation for any damage to their property caused by another party?

Consequently, it is the usual thing to find applications for Parliamentary powers for new or extended electric tramways opposed in Committee by the local gas companies. This opposition invariably takes the form of an effort to secure a protective clause, making the tramway undertaking responsible at common law for any damage to

1 This Parliamentary Blue Book, which is filled with the evidence and arguments desired by Mr. Beal, regarding this electrolysis problem, will be furnished by the Association to interested members at $1 per copy.

gas pipes or appurtenances which can be brought home to them, notwithstanding the fact that they may have conformed in every particular to the Board of Trade regulations.

The argument of the gas company in support of such a clause is somewhat as follows:

If these Board of Trade regulations are effective, as Parliament clearly intended they should be, then no damage to gas and water pipes will ensue, and no additional responsibility will accrue to the electric tramways under the proposed clause. If, on the other hand, the present Board of Trade regulations are not effective, as is undoubtedly the case, then, pending the effective revision of these regulations, gas companies should not be deprived of their common law rights to compel those who have damaged them to repair such damage. It is not merely the lawful privilege, but it is *the compulsory duty* of gas companies to maintain their pipes in constant service in the public streets. They have no option in the matter; failure will result in the confiscation of their property. Nor is there any legitimate reason why the public danger and cost of gas supply should be largely increased, in order that electric tramway undertakers may obtain greater profit from their operations. Nor should gas consumers be obliged to pay more for their gas in order that the fares of tramway passengers may be reduced; surely, each service must rest upon its own bottom. In view of the present state of the art of electric traction, *positive* precautions can and should be adopted by urban electric tramways to prevent electrolytic destruction of street mains and services; and such half-way measures as the Board of Trade regulations should represent merely the irreducible minimum of precaution, without which no electric tramways may operate, and should not confer wholesale exemption from responsibility for damage consequent upon such operations.

In certain cases such protective clauses, re-establishing their common law rights, have been obtained by gas companies, due largely to unquestionable evidence of actual electrolytic damage already sustained in these cases. But, owing to the comparatively limited and brief experience of electric traction in Great Britain, such damage has not yet generally asserted itself by external evidence of destruction. Moreover, gas companies have not always promoted the same kind of protective clause; and, as the Board of Trade has been made specifically responsible for regulations which will prevent fusion and electrolysis, while not imposing impracticable restrictions upon the tramways undertakings, Parliament have decided that any further protection required by gas companies must be obtained by inducing the Board of Trade to remedy the insufficiency of the present regulations, instead of by the insertion of special protective clauses in individual acts granting Parliamentary powers for electric traction. Now, as to what changes or new regulations are necessary to insure the immunity of street mains and services from damage by electrolysis.

Although great *improvement*—as at Bristol, Glasgow and elsewhere—can be effected in electrolytic conditions by the thorough bonding of rails and such construction of track foundations as to increase as much as practicable the resistance between the rails and earth, in connection with a properly balanced system of limiting the fall of potential in rail returns by the application of return feeders (or "suckers") to different points of the line;[1] it will nevertheless not be gainsaid that the best method of insuring practical immunity from electrolytic damage due to stray currents is the use of completely insulated circuits for the electric current. Indeed, in view of the very small difference of potential at which electrolytic damage will take place, this is universally conceded to be the *only* practical method which will or can prevent damage by electrolysis. Nor is there any unreasonable practical or financial difficulty in conforming to such conditions in urban communities. This is shown by the fact that an important proportion of urban electric traction is already operated with insulated metallic returns, and there seems little doubt that this system must eventually become general in all large centers of population. Hence, the wisdom of anticipating such conditions before wholesale destruction has been meted out to gas and water distributing systems.

In default of an effective alternative, it is clearly inadvisable for gas companies generally to resign themselves to the abrogation of their common law rights to compensation for (electrolytic) damage, in exchange for the imposition of tramway regulations which fall short of the compulsory use of completely insulated conductors for the return current. If electric tramways are required to conduct their operations in accordance with the best practical means of preventing damage to other statutory undertakings (*i. e.*, to use insulated metallic returns), then, in return for such effective precautions, gas companies may prudently consent to the relief of tramway undertakings from all responsibility for damage from stray currents, not due to negligence or lack of reasonable care in their operations. But until such reasonable protection can be legally secured, gas companies in the interest of the public as well as of shareholders, must meet any ineffective measure of relief (such as the present Board of Trade regulations) by insisting upon their common law rights to compensation for any damage that ensues from such insufficient protection.

As matters now stand in Great Britain, Parliament has virtually invited gas and water companies to induce the Board of Trade to alter its regulations so as to afford practical immunity from electrolytic damage. It is, therefore, to be expected that the gas and water companies will make concerted representations to the Board of Trade looking to the compulsory adoption by tramway undertakings—at least in large urban communities—of completely insulated metallic conductors for the return current, in consideration of exemption from liability for electrolytic damage.

Concerted action to secure the proper revision of the Board of Trade regulations governing electric tramway return currents must lead to far better practical results in Great Britain than can ever be obtained by the attempts of individual gas or water companies to maintain their common law rights to compensation for such damage as can be legally brought home to the electric tramways. For instance, in a town where there are several distinct tramway undertakings, how is it possible to bring home to the specific offender, with legal certainty, any damage occasioned by electrolysis? And, even if one could get an occasional pipe replaced, how would that compensate for the loss of gas and for the labor and expense of locating and proving the damage, not to speak of such possible consequences as fire, explosion and asphyxiation? Manifestly, an ounce of effective prevention is worth, in this case, tons of incomplete cure; and perhaps the most real benefit of agitating for the preservation of common law rights in Great Britain is that it tends to make the tramway companies more careful in their present construction and operation, and may encourage the Board of Trade more speedily to revise the regulations so as to give gas and water companies and others effective protection from electrolysis.

Great Britain.—Exhibit A.

Electric Powers (Protective Clauses).—The Joint Select Committee appointed to join with a Committee of the House of Lords to consider and report whether the grant of statutory powers to use electricity ought to be qualified by any prohibition or restriction as to earth return circuits, or by any provisions as to leakage, induction, or similar matters, and if so, in what cases and under what conditions, have considered the matters to them referred, and have agreed to the following report:

The Committee have taken evidence from Sir Courtenay Boyle, K.C.B., from Mr. Preece, Engineer-in-Chief and Electrician to the Post Office, from Major Cardew, Electrical Adviser to the Board of Trade, and the Astronomer Royal. Counsel appeared before them on behalf of:

1. The National Telephone Company.
2. The Railway Companies.
3. Electric Tramway Companies, and Electric Underground Railway Companies.
4. Electric Lighting Companies.
5. Municipal Corporations, England and Scotland.
6. Tramway Institute of Great Britain and Ireland.
7. Gas and Water Companies.

Her Majesty's Postmaster General was also represented, but not by counsel. The Committee have heard all the witnesses tendered by the several parties, and have agreed upon the following clause, to be inserted in all bills and provisional orders which authorize the undertakers, other than electric lighting undertakers, to use large electric currents, viz.:

Clause.—To be inserted in all bills and provisional orders which authorize any company, corporation, or person, collectively referred to as "the undertakers," to use larger electric currents for other than electric lighting purposes.[1]

(1.) The undertakers shall, in the use of electric power under the provisions of this act [order], employ either insulated returns or uninsulated metallic returns of low resistance. [This clause not to apply

1. For early descriptions of this *mitigating* method see 3 interesting papers by Messrs. Parshall, Trotter and Cardew respectively, read and discussed April 25th, 1 98, at the (British) Institution of Electrical Engineers; also, the discussions of Profs Perry, Ayrton, Thompson and Swan, favoring an insulated circuit—both for the safety of other interests and for reasons beneficial to the railways. For recent descriptions of this return feeder system see the German section of this Report.

1. Some modifications of form may be required to meet the circumstances of particular cases.

in the case of railways, tramways, or tramroads in which the motive power is entirely self contained.]

(2.) The undertakers shall take all reasonable precautions in constructing, placing and maintaining their electric lines and circuits, and other works of all descriptions, and also in working their undertaking so as not injuriously to affect, by fusion or electrolytic action, any gas or water pipes, or other metallic pipes, structures, or substances.

(3.) The exercise of the powers by this act [order] conferred with respect to the use of electric power, shall be subject to the regulations set forth in the schedule to this act [order], and to any regulations which may be added thereto or substituted therefor, respectively, by any order which the Board of Trade may, and which they are hereby empowered to make from time to time, as or when they may think fit, for regulating the employment of insulated returns or of uninsulated metallic returns of low resistance, for preventing fusion or injurious electrolytic action of or on gas or water pipes, or other metallic pipes, structures, or substances, and for minimizing, as far as is reasonably practicable, injurious interference with the electric wires, lines, and apparatus of other parties and the currents therein, whether such lines do or do not use the earth as a return.

(4.) The undertakers using electric power contrary to the provisions of this act [order], or to any of the regulations set forth in the schedule to this act [order], or to any regulation added thereto or substituted therefor by any order made by the Board of Trade under the authority of this act [order], shall, for every such offence be subject to a penalty not exceeding *ten* pounds, and also in the case of a continuing offence to a further penalty not exceeding *five* pounds for every day during which such offence continues after conviction thereof: Provided always, that, whether any such penalty has been recovered or not, the Board of Trade, in case in their opinion the undertakers in the use of electric power under the authority of this act [order] have made default in complying with the provisions of this act [order], or with any of the regulations set forth in the schedule to this act [order], or with any regulation which may have been added thereto or substituted therefor as aforesaid, may by order direct the undertakers to cease to use electric power, and thereupon the undertakers shall cease to use electric power, and shall not again use the same, unless with the authority of the Board of Trade, and in every such case the Board of Trade shall make a special report to Parliament notifying the making of such order.

(5.) The undertakers shall take all reasonable and proper precautions in constructing, placing, and maintaining their electric lines, circuits, and other works of any description, and in using their electric lines, circuits, and other works, so as not injuriously to interfere with the working of any wire, line, or apparatus, from time to time used for the purpose of transmitting electric power, or of telegraphic, telephonic, or electric signalling communication, or the currents in such wire, line, or apparatus. Provided always that the undertakers shall be deemed to take all such reasonable and proper precautions as aforesaid, if and so long as they adopt and employ, at the option of the undertakers, either such insulated returns or such uninsulated metallic returns of low resistance, and such other means of preventing injurious interference with the electric wires, lines and apparatus of other parties, and the currents therein, as the Board of Trade shall direct, and in giving such directions the Board shall have regard to the expense involved, and to the effect thereof upon the commercial prospects of the undertaking. Provided also that at the expiration of (?) years from the passing of this act [order] nothing in this sub-section shall operate to give any right of action in respect of, or to protect any electric wires, lines, or apparatus, or the currents therein, unless in the construction, erection, maintaining, and working of such wires, lines, and apparatus, all reasonable and proper precautions, including the use of an insulated return, have been taken to prevent injurious interference therewith, and with the currents therein, by or from other electric currents. If any difference arises between the undertakers and any other party with respect to anything in this sub-section contained, such difference shall, unless the parties otherwise agree, be determined by the Board of Trade, or at the option of the Board by an arbitrator to be appointed by the Board; and the costs of such determination shall be in the discretion of the Board, or of the arbitrator, as the case may be.

(6.) Nothing in this section shall apply to the use of any electric line, circuit, or work of any company, corporation, or person authorized by Act of Parliament, or Provisional Order confirmed by Parliament, to supply energy for electric lighting purposes, so far as such use is limited to such purposes.

The Committee have also agreed upon the following resolutions in the nature of recommendations, viz.:

(1.) The Committee having regard to the evidence before them, are of opinion that it is not in the present state of electrical science to the interest of the public to insist upon electrical tramways using an insulated return conductor, and that such insistence would retard the development of electric traction.

(2.) The chief objections which have been urged before the Committee to an uninsulated return conductor are: First, the interference by leakage and induction with telephones; secondly, the interference by leakage and induction with railway signals; thirdly, the damage to systems of gas and water pipes by the action of leakage currents.

(3.) They are of opinion that the best known means of overcoming the first of these disturbances is by providing an insulated return conductor for the telephones, and they have the less hesitation in recommending this course as the evidence shows that telephone construction is already tending in this direction, and that better results are secured to the public by the use of a twisted metallic circuit insulated entirely from the earth.

(4.) The second objection deserves serious consideration on account of the danger to the public, but the Committee are of opinion that the disturbance may be remedied at comparatively small expense by the adoption of an insulated metallic return by the railway companies.

(5.) They consider that, although electric tramway and electric railway companies should be allowed to use the wheels of carriages and the rails to complete the electric circuit, the current should be produced and used in such a manner as to mitigate as far as is practicable any injurious effect to telephonic communication.

(6.) The Committee are of opinion that it is desirable in every way to facilitate the use of complete insulated metallic circuits for telephones, and for this end they recommend that statutory powers be granted enabling telephone undertakers to lay their wires underground.

(7.) The danger from fusion or electrolytic action appears to the Committee to have arisen from a faulty system of constructing electric tramways, and they are of opinion that it can be reduced by improved methods of construction so as to be practically negligible.

(8.) The Committee, therefore, recommend that the Board of Trade shall, in virtue of the powers to be conferred upon them by each Act or Order, make regulations to secure the best system of working electric tramways and railways, having regard to the expense involved by the carrying out of such regulations, and to the effect thereof upon the commercial prospects of the undertaking. The regulations to provide, *inter alia*,

(*a.*) That a return conductor, if in contact with the ground, shall be of such section and resistance as to have no difference of potential sufficient to set up injurious leakage currents in the earth.

(*b.*) That, both with regard to the structure of the line and to the method of generation and use of the electrical current, everything shall be maintained up to the standard required by the Board of Trade; but, if the regutations are altered after the use of electric power on the line has been sanctioned, the undertakers shall not be required to alter the structure or method of working of the line to conform to the more recent regulations, except for the public safety, or unless it shall be proved to the satisfaction of the Board of Trade that any system of metallic pipes or structures is being substantially injured by the action of electricity escaping from the conductors, or for purposes other than public safety or injury to pipes or structures which the Board may think right, provided that the alterations do not in such last case cause substantial additional expenditure.

(*c.*) That all such electrical tests shall be applied to the line by the undertakers as the Board of Trade may think necessary, and that a record of these tests shall be kept for the information of the Board of Trade.

(*d.*) That the Board of Trade shall have all reasonable facilities for making any tests they may think necessary, in addition to those recorded by the undertakers to enable them to insure the maintenance of satisfactory conditions.

(9.) That the Committee regard with apprehension a large extension of the system of overhead wires in crowded centers.

(10.) It appears to the Committee to be just that undertakers proposing to use large currents should be required to give ample notice to those using small currents to enable them to protect themselves by insulation, and that with this view, and in reference to the clause agreed upon, a period of 2 years may fairly be allowed to telephone and telegraph companies from the date of the passing of any act [order].

13 July, 1893.

(To be Continued.)

THE works at Amarillo, Tex., are meeting with good favor from the residents. Water gas is made there.

Address of the President (Mr. Wm. J. Clark) of the National Commercial Gas Association, New York Meeting, January, 1907.

Gentlemen: In addressing the National Commercial Gas Association, on this, the occasion of its Second Annual Meeting, I think it is well to review briefly the year since our last meeting, keeping in mind the objects for which the Association was formed, asking ourselves what as an organization we have accomplished.

We remember that in some quarters the wisdom of forming such an organization as the National Commercial Gas Association was quite seriously questioned at the time, and some of the members had some misgivings as to the final outcome of such a movement, in view of the fact that the proposed amalgamation of the then existing several gas light associations had begun to take definite form, and the attitude of the proposed Institute toward our Association was problematical.

In view of the situation, it was thought well to provide for meeting whatever exigency might arise in the development of the Institute plan by appointing a committee to take up and promptly handle any such matter.

The President, therefore, under authority of the Association, appointed a Committee of Ways and Means of 15, of which Mr. H. B. McLean was made Chairman. In naming the committee, care was taken that each of the several interests in the gas industry, as represented in our membership, should have a voice—the gas appliance manufacturer, the gas company man, and the commercial gas man.

The Ways and Means Committee, as far as possible, kept in touch with the amalgamation movement, and had some correspondence with influential men interested therein. They found, however, that in the formulative state of the American Gas Institute, and until such time as the organization shall have been effected, nothing could be done officially looking to the affiliation of the gas appliance man as an active factor in the Gas Institute.

Just before the October meeting of the Institute, which was held in Chicago, the National Commercial Gas Association received an invitation to be represented officially at the Institute's initial convention, and was requested to prepare a paper to be read at the meeting. Your Ways and Means Committee were immediately called together, and it was decided that our Association should send a composite paper, expressing the ideas of our Association from the viewpoint of the manufacturer of appliances, the gas company man, and the commercial gas man, and the following named gentlemen were asked to prepare such a paper: Mr. C. A. Learned, Mr. J. C. D. Clark and Mr. R. H. Thomas. The paper was prepared, read, and discussed at the Institute meeting, and commendably spoken of in the GAS JOURNALS, and it evidently made an excellent impression.

I believe that up to the present time the detail of how the American Gas Institute will handle the commercial question has not been worked out, but that there is an inclination to, in some way, provide for an affiliation with the Commercial Association is not beyond the probabilities. In fact several of the active workers in the formation of the Gas Institute have individually expressed the opinion that co-operation with our Association is most desirable, and in some way should be brought about. However, in view of the fact that a large proportion of our membership is, under the Constitution adopted by the Institute, ineligible for active membership therein, and the position of the appliance man, so far as taking an active part in the proceedings of association work is possibly not as favorable as under the former conditions by reason of one of the largest and most progressive of the older associations, to the active membership of which he was eligible, having been merged in the Institute, your Committee on Ways and Means and Board of Directors decided that, at the January meeting of the National Commercial Gas Association, we should meet independently of any other organization, and also that an exhibition should be held. Acting for the Association, your President, Secretary-Treasurer and Chairman of the Ways and Means Committee began arranging the preliminaries of this meeting, and, after securing the room and fixing on other details, submitted the proposed plans somewhat in detail at a joint meeting of the Board of Directors and Ways and Means Committee, held in this room, December 3d, 1906. The plans as submitted having been approved, working committees were forthwith appointed, and these committees have been busily pushing the work. The evidence of their earnest endeavors you see in part about you.

I offer this much in answer to the question I asked at the outset of this address, what we, as an organization, have accomplished since our last meeting.

This work, which is in evidence, is but the initial move in the great work that has been started, for we feel that its influence will be far-reaching in the gas industry, and that it marks an era in the history of the commercial gas world, and we are confident that the feature of a gas appliance exhibit is one that will eventually attain to great proportions. That it is appreciated by the gas appliance manufacturer and dealer is evidenced by the prompt and hearty response which it has met. In about 2 weeks from the time the official announcement of the exhibition was made, all of the spaces had been rented, and this with no particular solicitation on the part of the Committee. With this condition obtaining at so early a period of the Society's existence, the promise of future exhibitions is most encouraging and their influence beyond computing. All that is required is a continuance of the energy and enthusiasm among the commercial gas men, the manufacturers and sellers of gas using appliances, as manifested in this, our first, exhibition. I look forward to the time when the entire industry will be arranging their dates of conventions and places of meeting so as to conveniently attend the National Commercial Gas Association's annual exhibition. Article II., Section I., of our Constitution states: The object of this Association shall be:

First.—"The promotion of increased sales of gas."

As we look about the exhibition room, noting the many appliances there displayed, and the evidence of the interest taken by the manufacturers and sellers of gas-using devices, it is unnecessary to ask the question as to whether or not we have accomplished anything worth while in this line.

Each of the manufacturers has the same story to tell of an unprecedented output of appliances for the year 1906, and the output of appliances means necessarily growing output of gas, new uses for which are being developed by the members of the National Commercial Gas Association continually. That the grade and efficiencies of the appliances are steadily improving is unquestioned, and to bring this about is one of the avowed objects of this Association.

In our exhibition we are providing what has been wanted ever since gas light associations have held meetings, and which the commercial gas man has long realized the necessity of, a chance to creditably show his goods. We all know the meager opportunities afforded at association meetings heretofore. Under previously existing conditions, if the manufacturer had enterprise enough he took the chance of shipping a range or two to some distant convention city, in hopes that he might inveigle the gas man into coming up to his room and looking at his stove. The lamp and lighting appliance man was scarcely any better off so far as advantageously exhibiting his goods was concerned. He had his lamp with him and no place to hang it—about on a par with a merchant having beautiful goods to sell and no light to show them by; and we must all take off our hats to the excellent qualifications of a salesman who can convince a customer of the high efficiency of his gas lamp while he holds it under his arm in the glare of the sunlight. We who attended the Milwaukee meeting remember that a room on the first floor of the hotel was set aside for exhibition purposes, our chief reason for remembering it being the difficulty we had in finding it. Unfortunately the morning I attended, someone was making toast "on the exhibition," and I was compelled to view it from the sidewalk through the show window.

We visitors filled the exhibition hall in relays of three; but, speaking seriously, the exhibition feature has been a crying need for years. It should do away with much of the expense of showing sample lines. How much more convenient it will be, and how much less expensive, to send goods to, and to go to a central point each year, to exhibit and examine the new lines, rather than to ship samples in every direction, subject to delays, breakage, etc.; and how much more convenient for the gas company buyer to go at a certain time of the year to some central point, knowing that there he will see all that is newest and best in the way of appliances for lighting, heating and cooking, and the thousand-and-one other gas using devices which otherwise might never be brought to his notice, and certainly in no such convincing and attractive way. Such an exhibition is bound to be a most valuable and instructive object lesson, and a stimulus to further inventive and ingenious efforts, and as an advertising medium should prove effective with the public and a great promoter of appliance sales.

Such a thing as our exhibition was hardly in the reach of the gas light associations to bring about. Certainly the gas manager and the gas engineer have no time to develop it, but it is vitally important that he keep in touch with it in the interest of his gas output, and, undoubtedly, now that it has become an established fact, he will give it his earnest support. We need his hearty co-operation, as we do that of everyone connected with the industry, and we feel that the commercial element is so much to the fore, and the commercial man so important a

factor in the profits of a gas company, that they hold a commanding position in the industry to-day, and are bound to command very universal attention.

Aside from the exhibition feature of our meetings, we have a wide field for profitable working. Methods of promoting business should occupy a large part of our time, and the discussion of these promotive features of the industry will be most advantageous to those who will attend the sessions, listen to the papers read, and discuss them or hear them discussed.

Our programme of last year was most attentively listened to through out, and held the interest of the convention during the entire session.

We have purposely requested that the papers be brief, with the idea of bringing about discussion in which we hope all will take part. The main criticism of other association programmes has been that the papers being much too long left too little time for their discussion. We believe that the more general the discussion the more earnest will be the work of the individual members, and as this individual work is the work which tells, we hope that each and every member will take a personal interest in all of the questions brought before the meetings. The subjects are almost limitless. Take the matter of maintenance of efficiencies. This most important subject should be followed up with as much energy and enthusiasm as the installation process, and it should be done by expert, conscientious help. Notwithstanding all of the educational work done by demonstrators, the construction and adjustment of the gas stove are still a mystery to the general run of housekeepers, and the correction of defects is beyond the ability of most users. The interchange of ideas as to how best to meet and remedy this condition will be most instructive.

Of course, local conditions exist in endless variety, but in our large field many parallel cases will be met with. In New York, where the gas range is largely in use the year round, and where the range, being a rental one, passes under many hands, we keep in close touch with our plant, and find it most advantageous to watch its efficiency. The rental range is not removed when the tenant vacates the premises, but remains for the use of the incoming tenant, and it is one of our best standing advertisements—here an exceptional condition obtains which perhaps would rarely be met elsewhere. This rental system puts the range selling business on a basis peculiar to New York. Range manufacturers and sellers often call on us and say: "You must sell thousands of ranges in New York each year. Why can't we get some of this trade?" And when we tell them there are comparatively few ranges sold in New York city they wonder at the statement until we explain to them the rental system and its inviting features to the builder and the housekeeper. Naturally the maintenance is followed up closely, and we keep in touch with the plant where we hold title to it more closely than we could or would if the title passed to the user, who under the rental system knows that we are under the obligation of keeping efficiencies right.

It goes without saying that efficiencies of lighting, as well as cooking appliances, should be maintained at their highest point to keep to the front with our friend, the electric light man, and as we get deeper into the incandescent gas lighting field the more careful attention this important factor should receive at the hands of the gas manager and the more extensive will become the lighting appliance maintenance departments of the gas companies.

I mention these things as showing how fields may differ and where exchange of ideas is necessary that differing conditions may be met and different experiences profited by.

Another most interesting subject which we should study is the matter of advertising methods; for what would appeal in smaller towns would not, in my opinion, be worth while in New York. Take, for instance, a follow-up mailing system. Among the flat dwellers this would entail an enormous amount of clerical work, of which a large part would be lost in trying to follow a "floating population." I remember that, while in charge of one of the up-town districts, statistics showed if each lock and unlock of a meter had represented the moving of a tenant, the entire one-hundred-and-odd-thousand consumers would have averaged a move in 11 months.

It may be interesting to you to know that there is a class of nomads in New York known among real estate men as "ruggers." These people never put down carpets (hence the name, "ruggers"). They move at short notice and, as a rule, pay no rent. It is needless to add that these birds of passage do not advise the gas company as to when they will take their flight or where they will "light" next. The gas men in our Association will appreciate that this runs distribution costs up abnormally.

Perhaps none of the out-of-town companies have to meet such conditions, and different methods are necessary in different territories. For instance, take the water heater installations on Manhattan Island. Probably the out-of-town manager who looks over the field superficially, thinks that with a population of 2 million in Manhattan and the Bronx, the field is limitless, not realizing that nine-tenths of the dwellers on Manhattan Island are not in the market for water heaters, as they are living in flats and apartments where hot water is supplied from a general hot water system. An earnest canvass for this trade results in our placing perhaps 1,000 to 1,500 each season, in what we term "cold water flats" and private dwellings and as auxiliaries to regularly installed systems. The price is no bar to their output, as we sell the standard size (copper coil or brass section type) for 30 to 40-gallon boiler at $8.50 cash, and $9 on installment plan, this price including the connecting. We also make an inspection of these appliances periodically and flush them to see that their efficiency is kept up. We use no iron section heaters on our district.

Perhaps these details of local conditions do not particularly interest the out-of-town gas man, and I mention them simply to accentuate the fact that the man on the ground is the one to solve the local problem; but he should always be open to conviction and willing to take advantage of any discussion and interchange of ideas which such a meeting as ours should bring out.

In conclusion, I wish to congratulate the National Commercial Gas Association on what it has achieved in its first year, and thank the members collectively and individually for their earnest and hearty support, and to bespeak for one and all a prosperous new year, and for the National Commercial Gas Association a great future.

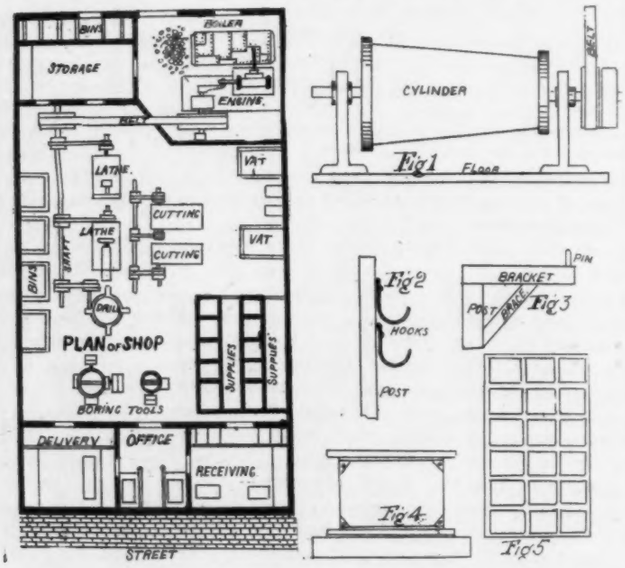
[Communicated by "R."]

Plan of Supply Shop.

I notice that regularly diagrammed shops are being erected about the country for the purpose of storing, maintaining and repairing gas lighting supplies. Some of these shops are very well equipped, and many of them have been provided with the most modern machinery for cutting threads on pipes for gas installations. Some of them are furnished with nickel plating apartments in which the portions of gas fixtures which need a fine, smooth surface may be coated. There are enameling tanks and ovens for blackening pipes; vats for the removal of rust and refuse from pipes, by saturation, so that new and clean surfaces may be put on; grinding and burnishing contrivances, and all the necessary devices for the maintaining of a system of pipes and burners for lighting buildings. Some of these shops are used in conjunction with large plants. Formerly the superintendents of the great corporations in the country either relied upon the nearest gas plants for repairs and general supplies, or they installed slipshod methods of providing equipments. Pipes, connections, burners and all parts of lighting equipments were thrown about under benches, on shelves and in bins. No regular method was employed. If something broke down in the lighting plant, a number of men would endeavor to find the part necessary among many other parts. There was confusion and time was lost. The modern plan of supply and repair shop has in it an apartment for every article.

Such a plant is available for the city or town in which there is amply of the repair work and new work to be done. It is suitable on a smaller scale for the use of the manufacturing corporation where considerable piping and burners are employed. Such a shop can be employed to advantage on a still smaller scale in the small factory or for buildings in general. It consists of the plan exhibited in the illustrations. Of course this is intended for service in cases where the business of pipe cutting and finishing is carried on in a large way. Contracts are taken for furnishing extensive equipments. There are an office and receiving and delivering rooms in front. The shop faces the street. Manufacturers and artisans seek for the main thoroughfare in these days, for though the back street shop gets cheaper rent, it loses considerable patronage. Hence we find many of the metal working and wood working shops of the present time right on the street fronts. In this case the front office is in the center of the building, at the forward end adjoining the sidewalk, where it is convenient to customers. Here the superintendent has his desk, clerk, books and accounts. He can direct the business from this common center. He can have telephones put in so as to reach the overseers of the various departments. He can have a messenger boy. On one side of the office is the receiving department. Here all work to be done is received and arranged for. Plans are received here and estimates made. Drawings are originated and completed with figures for the work put on. Repair work on pipes, chandeliers, globes, arcs, burners, lamps, lanterns,

etc., is all adjusted from this room, where the work is taken in, examined and marked for the necessary alterations, repairs or additions. It is then distributed at the points where the work is to be done. Perhaps the metal parts of a light installation are to be replated, or perhaps the joints are out of kilter and leaking occurs; again, an entire meter is to be overhauled, or there may be a system of pipes brought in for a model from which to construct a similar system. The attendants send out the work to the respective apartments. Hence we observe in the main shop, just back of the front apartments, are the different tools and machinery for carrying on the general work on pipes and gas lighting apparatus. There is the boring installation for drilling holes in metal parts of gas lighting equipments, the bins in which are carried the small work of pipes and joints, the tees, elbows, unions and angles of all kinds, the drills and lathes arranged next to the line of bins, in such manner that the driving shaft overhead can propel the necessary belts which are extended from the driver of the former to the driver of the machine on the level. The cutters are next. Therefore we have the equipments at hand necessary for the cutting of threads of all manner of size and design on the pipes. On the other side of the shop we can see a supply department in which are series of pockets arranged like bins for holding various sizes and patterns of parts of pipes and joints. There are likewise pigeon holes here for parts of lamps and electrical lighting devices. A young man is usually put in charge of this department (and it is a busy one as a rule), furnishing the gas pipe fitters and electric light men with supplies in the vicinity. Quite a profit can be derived by putting a small margin on each sale.



The plating division is another source of income to the works, for there are always fixtures in need of plating. The expense of plating is not great and on the average the prices charged are high, resulting in a good profit. Along the back of the shop are the boiler and engine. On the other side is the department of storage. This is a most handy room in which to retain supplies not in actual circulation. The sale bins may be filled, but as a rule there should be another place in which to retain boxed articles. Hence the use of the separate storage room.

Work is brought to the shop for cleaning. Also for removal of rust. The tumbler shown in Fig. 1 is often used for scratching the surfaces of articles, for the purpose of effacing rust or foreign matter. The cylinder is filled partly with emery and the articles for polishing are placed in this material, the cylinder being steadily turned by the driving belt. The friction of the emery on the surfaces of the articles removes the foreign substances and leaves the surfaces clear and polished. Fig. 2 shows a plan for supporting lines of pipes on hooks. The latter are put into the posts as shown, at intervals and the lines of pipes are placed in the same.

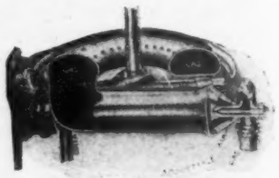
Sometimes the style of bracket illustrated in Fig. 3 is employed for this purpose. The bracket is constructed of wood, and is properly braced below on the post. A pin is set into a hole bored near the end of the bracket, and this keeps the pipe in place.

A number of chests of the order shown in Fig. 4 may be seen in use in the supply shops for retaining tools and small parts of gas lighting devices and effects. Such chests are always very useful for this purpose. Fig. 5 is a plan of shoot-hole device which is utilized for holding in apartments a number of different articles relating to the business. A number of these contrivances are employed,

There is opportunity to designate the contents of each apartment by using a printed label. Thus we pass through the various departments, and at the finish go towards the front once more, to the delivery room next the office, on the side opposite from the receiving room. In the delivery room another party is in charge. Having a check system to correspond with the check numbers of the receiving department, he can deliver all goods when ready, according to the number designated on the presented check. The check number designates the bill and price. The number always identifies the article during the processes of work in the shop and in the accountings in the books.

The Improved Rapid Water Heater and Burner.

After much study and experiment the Grand Rapids (Mich.) Rapid Water Heater Company announces important betterments in its device for the heating of water for bathing purposes. The Rapid heater is of that type in which as soon as the heater is connected up, a pilot light is lit and is kept continually lighted, so that whenever hot water is wanted, by opening the cold water supply faucet the supply of gas to the main burner is immediately opened. Then a large burner supplies sufficient heat to raise the water to the right temperature as fast as it runs through the heater. The water on entering the heaters is played against the hot plate, and, falling in a copper reflector, is gathered toward a central cone enveloping the gas flame. Perforations around the outer edge of the cone let the heating water fall down over the cone and finally find outlet at the hot water nozzle.



Gas Burner and Bracket.

Sectional View.

The cut of the burner shows that it supports a copper jacket to the water heater proper, and it is supported against the wall by means of a detachable connection with a strong cast iron bracket. The new burner enables both the gas and air supply to be adjusted to suit any kind or pressure of gas. The burner is cast in one piece, free from screens or sieves, which might clog with dirt. A feature of the entire construction is simplicity, so that every part may be detached quickly. It is durable to stand household treatment and also the effect of gas and water on the materials of which it is made. The adjustable features of the burner and the entire apparatus are pointed out by the Company as features well worth consideration by both the plumber and his customer.

Fixture Design and Location.

[A paper read by MAJOR E. L. ZALINSKI, U. S. A., before the Illuminating Engineering Society.]

The design of fixtures for electroliers is left, in a large measure, to manufacturers, most of whom appear to give but little thought to securing efficiency of illumination. Economy as to the construction of the fixtures, or of the cost of the resulting illumination, appears to be entirely beneath them, except in cases of active competition when they may attempt to lower the cost of fixtures. If the resulting illumination happens to be sufficient, it is ordinarily secured by the most wasteful expenditure of current. But the fixture makers do not pay these continuing bills.

It is the especial role of the illuminating engineer to secure proper lighting, avoiding uncomfortable physiological conditions at a minimum outlay for current or gas. It is this consideration that renders it advisable to give first consideration to fixture design and the location of fixtures.

In times past it was the custom to acknowledge frankly the necessities for suitable lighting, by the use of chandeliers more or less elaborate, suspended some distance below the ceilings, and by numerous brackets carrying one or more lamps attached to the walls, central posts and

pillars. No attempt was made to conceal them. In this way the lights ordinarily furnished a moderate degree of illumination somewhat commensurate with the expenditure of gas or electric current, as the lights were thus brought near to the planes where required.

But in these latter days the tendency has been either towards very wasteful indirect lighting, or to placing the electric lamps up close to the ceiling, or even above the same, at needlessly great distances from the plane where the illumination is required. Often, not being content with this unfavorable location, the lamps are covered with the large glass beads, well fitted to aid in destroying the little light left available.

An examination into the laws governing the intensity and distribution of light here appears desirable. It is a fundamental law that the intensity at any distance from the source of light is inversely as the square of the distance. This assumes a radiant point of light as being the source. In other words, the intensity of illumination at various distances from the source is thus computed in the attempt to secure definite illumination. The lighting arrangements are then made to conform to this, some allowance being made for the color tone of the walls and ceilings. A modified formula will have to be used where the source of light is not a point, as for example, in the cases of the Cooper-Hewitt and Moore tubular or similar lights, which may be said to have more than one dimension.

There is some question as to the strict applicability of the law of inverse squares to the cases where reflectors are used, even with single incandescent lamps. But unless these reflectors are in whole or part of the parabolic type, securing a reflection approximately parallel to the axis, the law of inverse squares must still apply, approximately at least.

In cases where the reflectors are partially parabolic, the law of inverse squares will apply to the angles outside of the axial angle, the rays of light being parallel at the latter.

Generalizing, three cases may be assumed:

1. Reflectors parabolic throughout, where the law of inverse squares will not apply at all.

2. Reflectors partially parabolic, where the law will apply to the extraneous angles, but does not apply to the axial and immediately adjoining angles.

3. Ordinary conical and dome-shaped reflectors where the law of inverse squares practically applies throughout the field, but must be based on actual photometric measurements at different portions of the field.

We may now assume that the reflectors used are not in part or wholly parabolic. Taking a concrete case, computations made on the basis of the law of inverse squares would indicate as follows:

The height of a ceiling is taken at 16 feet. The plane to be illuminated is taken at 3 feet above the floor, or 13 feet below the ceiling.

Assuming an intensity of 16-candle power at 1 foot distance, we have available at

4 feet	= 1.0	foot-candle.
5 "	= 0.64	" "
6 "	= 0.44	" "
7 "	= 0.32	" "
8 "	= 0.25	" "
10 "	= 0.16	" "
13 "	= 0.09	" "

The illumination demanded for ordinary good print reading is 1-foot candle; for newspaper print 2-foot candles; for the postal service 4-foot candles, and for drafting 10-foot candles.

Assuming the 2-foot candles at the plane 3 feet above the floor as the basis, if the light were placed at the ceiling, 338-candle power would be required to secure the requisite illumination at the 3-foot plane.

At 4 feet below the ceiling, this would be reduced to 162-candle power, or a little less than one-half.

At 6 feet below the ceiling it would be reduced to 98-candle power, or less than one-third.

At 8 feet below the ceiling it would be reduced to 50-candle power, or less than one-seventh. It is thus seen how very wasteful much of the usual lighting fixture arrangements are in the available illumination.

It is obviously desirable from consideration of economy and efficiency of illumination to place the lights as low down and as near the plane to be illuminated as possible, the gain thus secured increasing very rapidly. But various other considerations serve to limit and modify the extent of the lowering which is practically possible or desirable.

The high intrinsic brilliancy of the clear prismatic glass reflectors, in the axial angles, render it necessary for comfort to raise the lamps high, to avoid the uncomfortable glare incidental thereto. The higher candle power obtained at the axial angles render this feasible, but this results in a reduced illumination at the extraneous angles. Diffusing reflectors having a lesser intrinsic brilliancy may be placed lower and nearer the eyes without injury to the latter.

The law of inverse squares has application not alone in the height of placement of fixtures, but has also direct application in the matter of most advantageous subdivision, lateral distribution and number.

Considerable variation in the maximum and minimum of the illumination becomes, for physiological reasons, most disadvantageous. The retina of the eye quickly adapts itself to the brightest lights, reducing its opening accordingly. Where adjacent zones are of a comparatively lower intensity, they thus are made to appear relatively darker, and the illumination consequently becomes more ineffective in securing distinct vision of details.

For these reasons a more uniform illumination is desirable, with an avoidance of high intensities and a lessened variation between the maximum and minimum. By the use of the smaller units the variation in intensity is minimized. It is, therefore, more advisable to have a larger number of smaller units, well distributed, than a smaller number of the larger units. The small units also secure an avoidance of deep shadows which are detrimental to clear vision and a due appreciation of the proportion and relation of objects in the field of vision.

The lamps must be well above the head and eyes. A distance of 8 feet from the floor is assumed as a minimum height, giving ample head room and being above the direct vision of the eyes.

Fig. 1 is a sketch of a fixture for a 13½-inch diffusing reflector with a

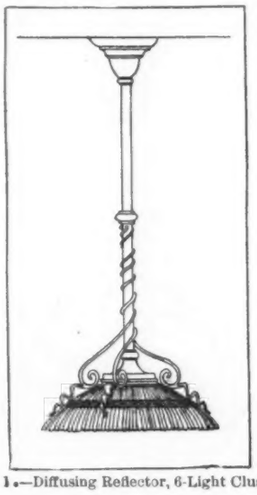


Fig. 1.—Diffusing Reflector, 6-Light Cluster.

Benjamin or other cluster, the stem being here of greater length than usually adapted to such fixtures.

Fig. 2 gives the distribution curves of reflectors as illustrated in Fig. 1.

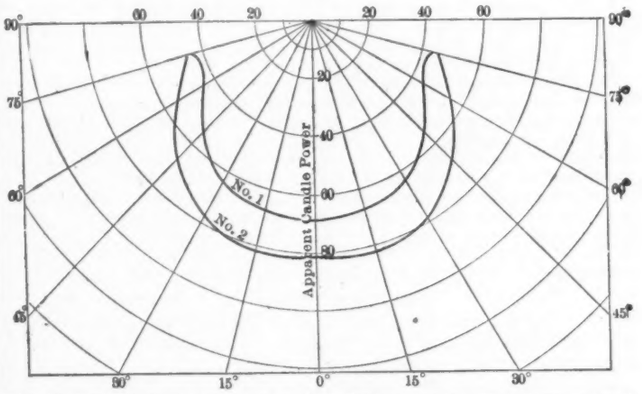


Fig. 2.—Distribution of Light about 3-Light Cluster. Curve 1, Plain Glass Prismatic Reflector. Curve 2, Same, with Diffusing Backing.

Curve 1 is of a plain prismed glass reflector, and curve 2 that of the same reflector with a diffusing backing. It is seen that the latter in this case gives superior results, both in the axial and the extraneous angles, to those from the plain prismed glass. The diffusing reflector is on a parity with the plain prismatic when at about 40° on either side of the horizontal. This, of course, bespeaks for the former a superior distribution and more efficient illumination.

Fig. 3 is another form of fixture for the 13½-inch reflector. Fig. 4 is

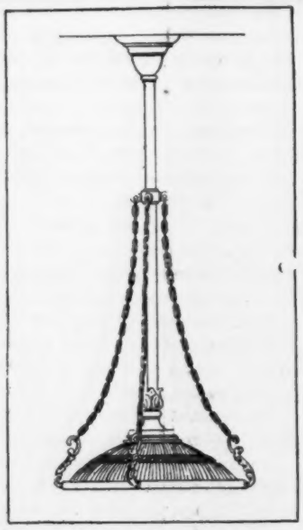


Fig. 3.—Diffusing Reflector, 6-Light Cluster.

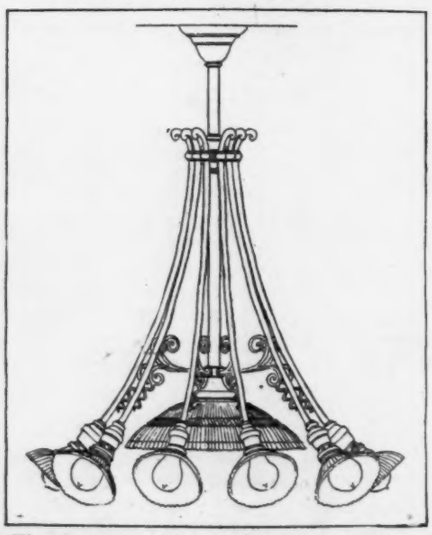


Fig. 4.—Six-Light Cluster and 10 Diffusing Reflectors.

a form combining the 13½-inch reflector with others, mounted on the same electrolier in such manner as to secure a broad distribution. It is obvious that these simple designs can be made much more ornate if desired.

A good general illumination is of the first consideration, but may be of a very moderate intensity according to the general conditions. But besides this, there should be provided locally, illumination of higher intensity to provide for special conditions.

The illuminating engineer not infrequently meets with difficulties in making his designs in accordance with the requirements for proper illumination, because of the fact that not infrequently the wiring has been done independentiy. It is obviously desirable to have the wiring done under plans made by the illuminating engineer, who can thus design the arrangements untrammeled by unsuitable wiring.

There is much to be discussed in the consideration of illumination from the various points of view of fixtures and their location. I trust I have succeeded in calling attention to some of these, and I hope this matter will be taken up for further consideration by illuminating engineers of broader experience than myself.

The First Use of Gas in Barrel Making.

Gas News, of the Public Service Corporation of New Jersey, in its last issue, respecting the matter named in the heading, notes that "Barrels are a lot like women, contrary and hard to handle; but if you treat them right you can do anything with them." So said William Taylor, Newark's "Barrel Man."

Barrels are sent into the large coopering establishment of William Taylor from varied and various sources. To follow a barrel through its lengthy career one must begin with the brand new, fine looking sugar, flour or cracker barrel, which is usually sent East, filled, from the Middle States.

After re-coopering it starts on its next journey; it is used for bottled beer, then for heavy packing, such as iron castings, etc. Soon it is returned to be overhauled and sent out on its last pilgrimage to do duty for carting all kinds of farm products, such as apples, potatoes, etc.

This is the life of a barrel, which is used from beginning to end in its regular size; but some barrels, after the first and second trips, are made over. Of these those which are made larger simply receive an extra stave and are used generally for packing carpet yarn.

The barrels that are made smaller are sawed off from the top, after which, to shrink the staves and make them easily pliable, heat is necessary. Ever since barrels were first made over in this way, coke, coal or wood has been necessary in the process; but Mr. Wm. Taylor is trying an experiment, which has been in use long enough to prove its great possibilities in the coopering business. This new method is the use of a specially made gas stove, over which the barrel can be set. This may be used in any part of the work room by attaching it to any gas outlet; it requires no engine, and one man can easily take entire charge of it.

Mr. Taylor, who is the first cooper to try this new method, is more than pleased with the experiment and has done away entirely with the the stoves which he formerly used. He is absolutely satisfied with it, which is rather remarkable when we consider that it is in an experimental stage.

The Pettit & Barrows Gas Washer.

By Mr. Frank Pettit.

A new form of gas cleaning apparatus for removing dust from blast furnace gases has been patented by Frank Pettit and W. A. Barrows, Jr., of Sharpsville, Pa. It belongs to the class of primary cleaners, intended to treat initially large volumes of blast furnace gases (60,000 to 75,000 cubic feet per min.) in a simple and inexpensive manner. The apparatus has no moving parts and requires practically no attention. Its purpose being the cleaning of gas suitable for burning in stoves, boilers, etc., it does not aim to perform the functions of an expensive gas refining plant, necessary only for gas engines.

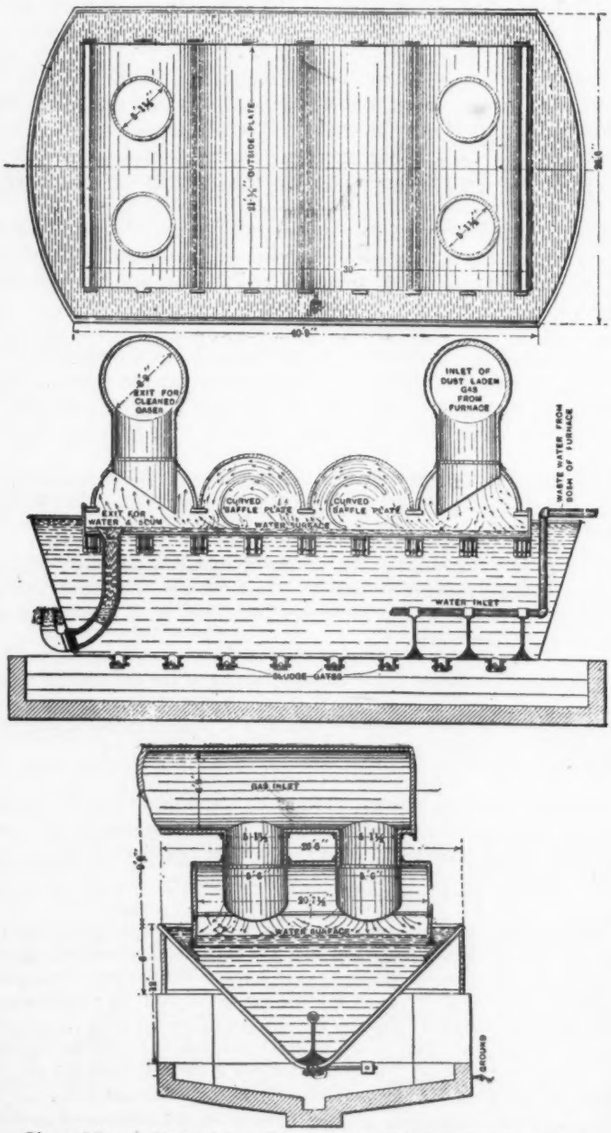
Ever since the waste gases from blast furnaces have been diverted and applied to useful effect, trouble has been experienced by accumulations of dust carried over by the gas currents and deposited in flues, under boilers, in stoves, etc. Even previous to 1850 European engineers constructed apparatus for the removal of dust by passing the gas over the surface of water, similar to those in present use. At the moderate rate blast furnaces were driven in the earlier days, and the favorable character of the ores then in use, but little dust was carried over, and with suitable cleaning doors provided it could be removed easily by hand labor. With the advent of the present large blast furnace, driven at a pressure of 20 pounds per square inch, employing a a higher temperature, and, still more recently, the discovery that it was feasible to use high percentages of, or all, Mesaba ores, the problem of dealing with the dust became serious; 3 to 5 per cent. of the ore fed into the furnace passed out as dust. This resulted in one stove and one or two boilers to each furnace being continually idle, while the dust was removed by expensive hand labor. This naturally resulted in calling forth numerous devices designed to meet the evil.

The fact, discovered by the early French engineers, that extremely fine particles of ore suspended in furnace gases adhere readily to the surface of water when brought in contact with it, has formed the basis of the most successful of these present devices. The next difficulty arose from the forming of a coalescent scum on the water surface, apparently of fine coke dust and heavy hydrocarbons produced by chemical reactions within the furnace, this scum soon rendering the apparatus inoperative unless provision is made for continually removing it. This can be readily illustrated by holding a porcelain tray of water near a small gas leak.

The efficiency of an apparatus for removing the finer impalpable dust particles depends solely upon the extent of clean water surface in con

tact with the gas and the throughness with which the gas is stirred and forced to present new surfaces to the water.

The illustration shows a gas washer suitable for use with a furnace



Plan and Longitudinal and Cross Sections of the Pettit & Barrows Gas Washer.

producing 300 to 400 tons of iron per 24 hours. It consists of a water vessel with inclined sides, provided with sludge gates at the bottom for drawing off sediment, and a gas chamber, closed by a water seal on all sides, which permits scraping the sediment from the sides of the water vessel while in operation. The gas enters at one end of the chamber, preferably by two nozzles as shown in the end elevation, for better distribution, making one impingement on the surface of the water, thence passing to the first curved baffle plate. The larger portion follows the course between the baffle and the inner side of the arched cover, causing it to be directed downward against the water surface a second time. Part of the gas is caught in front of the curved baffle, forming an eddy, and finally escaping beneath. After a repetition of this process the gas leaves at the opposite end. All scum, hot water and floating matter rising to the surface are driven by the gas currents to the discharge end of the gas chamber and swept out the overflow. This feature, which insures the water surface being always clean and active, is patented.

The apparatus is set sufficiently low for the waste water from the bosh of the furnace to furnish adequate supply by simple flow. The method shown of applying the water prevents the sediment from packing between the sludge gates, facilitating its removal. The only attention required is to draw the sediment from the sludge gates every 8 or 10 hours, allowing it to flow to a settling pit, from which it is easily dredged out every 24 hours by the crane that serves the cinder pit, either to be discarded or to be formed into briquettes.

The top and sides of the gas chamber are brick lined to avoid undue loss of heat from the hot gas, which is usually at a temperature of 400° to 600°,F. The gases can be discharged directly from furnace into this washer, its large passages being free from clogging in case of even the heaviest slip.

A gas washer of this type has been in use for 2 years at the plant of the Shenango Furnace Company, Sharpsville, Pa., during which time it has well demonstrated its capacity to remove dust, withstand frequent heavy slips of the furnace, gas explosions, and the action of hot gases on the inner baffles.

In use a thick scum gradually rises on the water surface outside the gas chamber, attaining a thickness of several inches, and able to support an umbrella or walking cane. It is reasonably certain that in an apparatus not provided with means for its continuous removal the water surface within the gas chamber is similarly fouled. An approximate cost of this washer may be placed at $10 per square foot of active water surface in contact with the gas.

Outline Lighting.

[A paper read by Mr. Homer Honeywell, Gen. Mgr., Lincoln (Neb.) Gas and Electric Light Company, at the last meeting of the Northwestern Electric Light Association.]

The Lincoln Gas and Electric Light Company organized a New Business Department with a competent manager at its head, about the first of February, 1904, and started out with well defined ideas as to the desirable classes of business and the effects on the station load. It was the aim to take on a steady load that would run from dusk until midnight each and every night during the year, and to that end a flat rate was figured out based on the Doherty rate of $1.80 per year for each connected 16-candle power lamp, or its equivalent; $12 per year for a customer charge and 6 cents per kw-hour for energy used, all subject to a discount of 10 per cent. for prompt payment, and on the actual number of burning hours as applied to Lincoln.

No flat rates are taken on inside lighting. We have free renewals and do it whenever our men see a defective lamp in use.

The outlining is installed free when 2-year contracts are taken and the cost of installation figures about 38 cents per 4-candle power lamp installed, the lamps being placed 18 inches apart. By this method a number of small stores were induced to light up. The small merchant with a strip of seventeen 4-candle power lamps over his sign, burning each and every night from dusk until midnight, turned on and off by us, pays $5.30 net per month. At the present time there are in use the equivalent of 10,000 4-candle power lamps for sign, outlining and window lighting, and used by barbers, shoemakers, livery stables, undertakers, second-hand stores, bootblack stands, butcher shops, lunch cars and popcorn stands; in fact, all kinds of business. No business is too peculiar or small to be a "prospect." We have one customer, a clothing store, whose sign, outlining and window lighting, amounts to 960 4-candle power lamps. This was the first customer to get into the game and we have used him as a pacemaker.

It is claimed that the display lighting is one of the most valuable assets of Lincoln and it certainly has a far reaching effect. People promenade the streets and can inspect the goods displayed at their leisure. All of the large sized show windows have light-colored stucco ceilings and are lighted by trough reflectors. Artistic, well dressed, frequently changed windows are the rule in Lincoln. Progressive merchants, aided by the Doherty rate, are responsible for the handsome appearance of the streets at night. Had we attempted to install display or advertising lighting on a flat meter rate, even though the rate was lower than the present rate, it is more than doubtful if we could have gotten the merchants interested. An appeal to the merchant's civic pride and a showing of the very small cost for a big lot of good advertising works wonders. Six o'clock closing is the rule in Lincoln every night except Saturday, and it would seem that the smaller towns, where the stores keep open every night or two nights a week, and the people have few places to go, would offer a fine field for display lighting. Well lighted windows and outlining displays will bring the people on the streets at night, cause the merchant to put better goods in his window and display them to better advantage.

In soliciting we are always careful to impress on the prospect's mind that the outside and window display is an advertising and not a lighting expense.

Solicitors are paid a small salary and a percentage of the increase in gross revenue over the same month for the previous year. Each solicitor's commission depends on the number of points he has in proportion to the total number turned in and points are given for each dollar of estimated revenue, as follows: Industrial business, 10 points; additional

inside consumption, 10 points; new contracts, 5 points; outlining or signs until 12 o'clock, 10 points; outlining or signs less than 12 o'clock, 5 points; outlining or signs on meter, 3 points.

If the business is taken from the competition the points are doubled. Each man is responsible for his own territory and is keen to hold business as well as to get new business.

Personal solicitation, newspapers, mail advertising and personal letters are used and the cost of getting business to the company for the past 3 years has been 43 cents for each dollar of increased revenue procured. The costs are divided as follows:

Advertising	.05
Construction	.15.05
Solicitation	.22.05

Of the advertising done at the start I believe the mail advertising was the most valuable. It was done on a fairly large scale and in a way that was new to a great many people. The first week one letter or card was sent out, the next week two, and so on until the prospect received a letter or card every day. The mail advertising helped put the prospect in a receptive mood and the solicitor was able to close quickly. The combination of mail advertising and personal solicitation is a strong combination.

The effect on the station has been gratifying. The increase in peak load has been 23 per cent., while the sales have increased 60 per cent. The sale of signs was not pushed particularly until we had made considerable headway in the other forms of lighting. At the present time we have 48 lamp-lettered signs in use, all of them bought outright from the local sign builder. The reason for installing free outlining on 2-year contracts, and not installing free signs, is apparent The outlining can be taken down, be repainted and put up again anywhere at a very small cost, while a sign to be used again would have to be remodeled at a considerable expense. Then, too, the first investment for a sign is considerable, and if the merchant is not required to carry the investment he feels more free to discontinue the use of the light. During the past 3 years we have not had over 5 or 6 outlining contracts discontinued, where the merchant remained in business, but on the other hand most customers have increased their display.

There are in use 8,500 4-candle power lamps for sign, outlining and sidewalk showcases. All these are on a flat rate. For window lighting, 900 16-candle power lamps are used. Outlined roof signs also seem to be a popular and cheap method of advertising. So far all the outlining has been done along straight lines, but we are now attempting to relieve the plainness by getting into curves and circles.

Our sales for the past year have been 689 kw-hours for each kilowatt connected. The Sunday output runs about 63 per cent. of the average weekly output, and is largely due to flat rate lighting.

There is a municipal street lighting plant here and the traction company supplies some commercial light and power; but the generous display lighting is not due to competition, as our so-called competitor has but three outlying customers and two customers using signs of respectable proportions.

Discussion.

The discussion on Mr. Honeywell's paper served in general to call attention to the tendency to adopt flat rate contracts for sign lighting and have the company turn the signs on and off, rather than depend on time switches or on the customer, who may try to economize by having his sign off much of the time when it would be on under a flat rate contract. Mr. Almert said he had not had very good experience with time switches so far, but he stated his expectation that a better switch would be available soon.

Mr. John S. Allen, of Lake Geneva, arranged with each customer to turn his own sign on at dusk and this privilege was rarely abused. He then contracted with the night policeman of the town to turn off the signs. In this way the turning on and off was done in a small town without the expense of a patrolman. He called special attention to the figures given in Mr. Honeywell's paper as to the increase in load at Lincoln, where the sales have increased 60 per cent. and the peak load on the station only 23 per cent. as a result of taking on this class of business.

Mr. W. B. Johnson, of Madison, thought that as a rule signs were easier to introduce than outline lighting, because they were more distinctively an advertisement for a certain merchant. As to the effect of show window lighting, it was a good plan for the solicitor to have the merchant watch his show window from the back of the store when the interior of the store was dark, noting the number of persons who had stopped to look at the show window when lighted and the number who stopped when the window was not lighted. A demonstration of this kind is very convincing. At Madison they have the equivalent of 8,000 4-candle power lamps on flat rate contracts in sign, outline and show window lighting.

Mr. Lord, of Waupaca, said that the early closing of stores which was now quite general had affected central station revenues seriously in the past few years. Display lighting of this kind would get back some of the revenue lost through the shutting off of the lamps in the interior of a store. In small towns flat rate sign contracts would have to provide for turning off current much earlier than in cities.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Directors of the St. Paul (Minn.) Gas Company have chosen the following executive management: President, Emerson McMillin; Vice-President, Kenneth Clark; Second Vice-President and General Manager, Paul Doty; Secretary and Treasurer, John P. Crowley.

THE Allegheny County (Pa.) Light Company has arranged to do the public lighting of Pittsburgh in so far as the major part thereof is done by means of electric currents, at the rate of $76 per arc per annum, arcs to have a nominal candle power of 2,000.

MR. GEORGE KIMBLE, formerly connected with the Muscatine (Ia.) Company, has assumed his duties as Manager of the plant at Cadillac, Mich.

THE officers to direct the affairs of the Wilmington (O.) Gas Company for the ensuing year are: President, G. N. Clapp; Vice-President, A. L. Cole; Secretary, F. M. Clevenger; Treasurer, S. G. Smith; Superintendent, Frank Gates.

THE Directors chosen at the annual meeting of the Employees' Relief Association, of the Georgetown (D. C.) Gas Light Company, were: Jas. O'Donnell, L. S. Hart, Martin McQuade, J. F. Spellman, John Southey, Thomas F. Holden and James Magee.

MESSRS. JOHN HEMINGWAY, Thomas F. Welch and Chas. F. Hamlin have been appointed a committee to draft the petition that is to be presented by certain capitalists to the Connecticut Legislature for its consent to their operating a gas works in Southington.

RECENT contracts awarded to the Western Gas Construction Company, of Fort Wayne, Ind., are: A 6-foot extended carburetter, double superheater set of water gas apparatus for the Wilmington (Del.) Gas and Electric Company. It is the second order that the Construction Company has received from the Wilmington Company for the named type of apparatus. The contract also includes the condensing and scrubbing apparatus, and the rated capacity of the machines is 1,400,000 cubic feet per diem. A second contract is for a storage holder up to retaining 75,000 cubic feet, planned to permit of the addition of another lift. The holder is to rest in a steel tank and is to be erected on the plant of the Mount Clemens (Mich.) Gas Company. A third contract is for an 11-foot extended carburetter, double superheater apparatus, complete, with scrubber, condenser and P. & A. tar extractor, for the St. Paul (Minn.) Gas Light Company. This contract includes the operating floor as well as the main apparatus.

THE Cleveland (O.) Gas Light and Coke Company's new President is or will be Mr. Henry L. Doherty, said the Cleveland *Leader*.

MR. WALTER M. BLINKS has been elected a Director in the General Gas Light Company, of Kalamazoo, Mich.

MR. FRANK E. HOLDEN, President of the Woonsocket (R. I.) Gas Company, has removed his business office to Woonsocket from Providence.

ON and after April 1st the net gas rate in Chelsea, Mass., will be reduced to 95 cents from $1 per 1,000 cubic feet.

THE proprietors of the Taunton (Mass.) Gas Company have determined to extend their main system to the outlying districts of Raynham and Dighton.

IN our issue of the 28th ult., in referring to the Northern Alabama Gas Company, we inadvertently located its headquarters in Birming-

ham, Ala., instead of Florence, Ala. All the rest of the item goes, however.

MR. JACOB A. WISE, a long time resident of Pawtucket, R. I., and since 1880 in the employment of the Pawtucket Gas Company, died at his home in that city about a fortnight ago. He was in his 59th year, and was a prominent member of the Pawtucket Veteran Firemen's Association.

AT the annual meeting of the Portland (Me.) Gas Light Company the officers elected were: Directors, E. H. Davies, Wm. H. Moulton, F. N. Dow, Elias Thomas, Chas. S. Fobes and F. H. Verrill; President, F. N. Dow; Vice-President, Wm. H. Moulton; Treasurer, Burton Smart; Clerk of the Board, Burton Smart; Superintendent and Engineer, Eugene H. York.

A PETITION has been filed in the Court of Common Pleas under which the Court is asked to dissolve the Ashland (O.) Gas and Electric Company, the averment being that the Company is unable to pay its debts.

MR. HINSDALL PARSONS, President of the Mohawk Gas Company, of Schenectady, N. Y., is authority for the statement that the plant will be completely rebuilt.

UNDER its new franchise agreement the Marion (Ind.) Gas Company may supply a mixed gas (natural and artificial) at the rate of 50 cents per 1,000 cubic feet.

AT the annual meeting of the San Diego (Cal.) Consolidated Gas and Electric Company the officers elected were: Directors, H. M. Byllesby, M. P. Fowler, D. F. Garretson, C. E. Groesbeck, U. S. Grant, Jr., and F. W. Jackson; President, F. W. Jackson; Vice-President, H. M. Byllesby; Treasurer and General Manager, C. E. Groesbeck; Secretary, M. B. Fowler.

MR. H. S. SHAW, Treasurer of the Webster (Mass.) Gas and Electric Company, has presented a petition to the Legislature asking for the right to consolidate with the Southbridge Gas and Electric Company, and to increase its capital to $250,000.

A CUT of 5 cents per 1,000 cubic feet in the net gas rate was announced the last of January by the Providence (R. I.) Gas Company, the same to become operative April 1st. Bills are to be made out at $1.05 per 1,000, and payment on or before the 11th day of the month in which they are rendered brings into play a discount of 10 cents per 1,000.

THE proprietors of the Southbridge (Mass.) Gas and Electric Company, after carefully considering the matter, have virtually determined to put the gas supply on the flat rate basis of $1.50 per 1,000 cubic feet, the same to go into effect about May 1st. The prevailing custom there is to charge $2 per 1,000 for a lighting supply and $1.50 per 1,000 for fuel account.

A BILL is before the Connecticut Senate that proposes a maximum figure of 80 cents per 1,000 for gas sold in cities having a population of 50,000 or over.

THE Mayor of Philadelphia has named Messrs. Wm. G. Huey, Wm. S. Kimball and Thomas M. Eynon as the Committee of Three to recommend to City Councils whether or not it is advisable that the city should, in accordance with the terms of the lease, take over the gas plant operated by the United Gas Improvement Company this year, or suggest that the Company be continued in the operation thereof for a further period of 20 years. The two first named gentlemen are "business men," Mr. Huey being a member of the banking firm of Wm. G. Huey & Co., while Mr. Kimball is President of the Equitable Brick Company. Mr. Thomas M. Eynon, who is rated as an Engineer—he is a member of the American Society of Mining Engineers and also of the University Club—is the Vice-President and General Manager of the Eynon Manufacturing Company, which concern, we believe, is engaged in the machinery trade. It would seem rather in accordance with good practice that a gas engineer of the first rank had been chosen to go into the engineering details, advisory to his fellow committeemen, but the Weaver shuttle evidently was not moved in such way.

Mr. LOUIS HARE informs us that Mr. Joseph B. Acker, of Brooklyn, N. Y., has been awarded the contract for the refilling of two benches of 6's, half-depth recuperative style, for the Hudson (N. Y.) Gas Light Company.

A CONTEMPORARY notes that the details of a very important concession has been published in the "Diario Official," from which it appears that Messrs. Edward Daheny, Chas. A. Canfield and Norman Bridge have been granted a concession to erect and operate, in any city or town in the Republic of Mexico, gas plants for the manufacture and distribution of crude oil gas. The concession allows the free importation, for a period of 10 years, all machinery, pipes, materials and appliances required for the complete installation of gas works and distributing systems. The concessionaires obligate themselves to commence the actual construction work within 6 months; to invest $500,000 and to furnish gas to the districts of Santa Maria, San Rafael, Juarez and Roma, in the federal district, within 4 years. This new industry to supply a commercial gas made from crude oil, and to be supplied at a moderate cost, is made possible by the late development in the oil district adjacent to Tampico. In addition to the active development of this oil field, preliminary surveys for an oil pipe line in which to deliver the oil to the City of Mexico are being made. This mode of delivery of oil to the city will so cheapen the cost that the resulting gas can be sold at such a price as to make a ready demand for it. The Company organized to operate under the concession will be known as the Mexican National Gas Company. The construction of a plant to supply the City of Mexico and suburban towns of Tacubaya, Mixcoac, San Antel, Cherubusco, Tacuba, Atzcapotzalco, Coyoacan and Tlalpam has been decided. From the date of publication of the above concession the capital invested, as well as all shares and bonds issued, shall be free of all direct Federal tax, with the exception of the stamp tax, for 10 years. James W. Warren, of Los Angeles, Cal., will be the General Manager of the Company. He expects to have the plant running to supply the City of Mexico and suburbs within 1 year.

THE application of the authorities of Paterson, N. J., asking that the Public Service Corporation of New Jersey shall extend its gas mains to the outlying section of Stony Road, or West Paterson, is likely to obtain favorable consideration.

THE Gas Machinery Company, of Cleveland, O., reports that the new plant installed by it as per contract with the Columbus (O.) Gas and Fuel Company, was started in operation the last week in January, and not a hitch marked the ceremony. The contractor for this work in its entirety was Mr. J. A. Mayers.

COLUMBIA CITY, IND., is considering the advisability of establishing an artificial gas plant.

ASSEMBLYMAN HARPER has introduced a bill in the Legislature under which it is sought to put the price of gas in Seneca Falls and Waterloo, N. Y., at $1.25 per 1,000. Last year the Legislature passed a bill putting the rate in the named places at $1 per 1,000 cubic feet, but Governor Higgins vetoed the measure on the ground that any relief in the premises should come from or by the State Commission of Gas and Electricity.

MR. R. W. HARBOR has resigned as Secretary and Treasurer of the Lincoln (Ills.) Gas and Electric Light Company, in order to assume a responsible position with the Childs-Hulswit Company.

THE officers of the concern that is proposing to establish an opposition light corporation in Davenport, Ia., to be known as the Independent Power and Light Company, are: President, C. J. Von Maur; Vice-President, Wilson McClellan; Secretary, George M. Bechtel; Treasurer, Julius Hasler.

EX-SENATOR A. W. PAIGE, of Bridgeport, Conn., has associated himself with the American Lighting Company.

A VERY odd action is that recently brought by Col. Walter W. Scott, of Dover, N. H., on account of Mrs. Mary E. Keenan, administratrix of the estate of John Keenan, who sues Frank B. Williams for $7,000. The suit is brought to recover damages for the death of Mr. Keenan, which was caused by his coming in contact with a live electric light wire while at work, May 19th last, painting an electric light pole at the junction of Silver and Cushing streets, Dover, the allegation being that Mr. Keenan was set to work there by Mr. Williams, the defendant, without the knowledge of the United Gas and Electric Company, and that Mr. Keenan, not having knowledge that the current was on, came in contact with the wire and met his death.

THE State Commission of Gas and Electricity has named the 15th inst. as the date for a hearing respecting the petition for a revision in the rates charged by the Saratoga Springs (N. Y.) Gas Company.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. H. SANDERSON,
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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEBRUARY 11, 1907.

The Market for Gas Securities.

The market for city gas shares was not much in evidence last week, although some trading was reported in Consolidated which the professionals managed to mark down to 133. At noon to-day (Friday) it is quoted at 134 to 135, at which figures it is below its real value by at least 50 points. That may seem a bombastic assertion, but the value is there nevertheless. Brooklyn Union shows no change in quotations.

Peoples, of Chicago, is 97¼ to 97½. Keep this stock well in sight, and do not overlook Massachusetts Gas Companies, at 65 to 65½. Bay State, despite the "Rogers settlement," is ½ bid. The gas bond market is fairly active, even obscure issues do not wait long for purchasers.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEBRUARY 11.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	134	135
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	225
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	98¼	100
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	110	120
1st Con. 5's, due 1948, M. & N	15,000,000		107	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅝
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,280,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,550,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	100	100¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,582,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,300,000	50	200	204
Consolidated, Baltimore	11,000,000	100	»	90
Mortgage, 6's	3,500,000	..	..	115
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107½	108¼
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	990,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	210
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	65	65¼
Preferred	25,000,000	100	85	85¼
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97¼	97½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	102	..
Washington, D. C	2,600,000	20	281½	285
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	230	..

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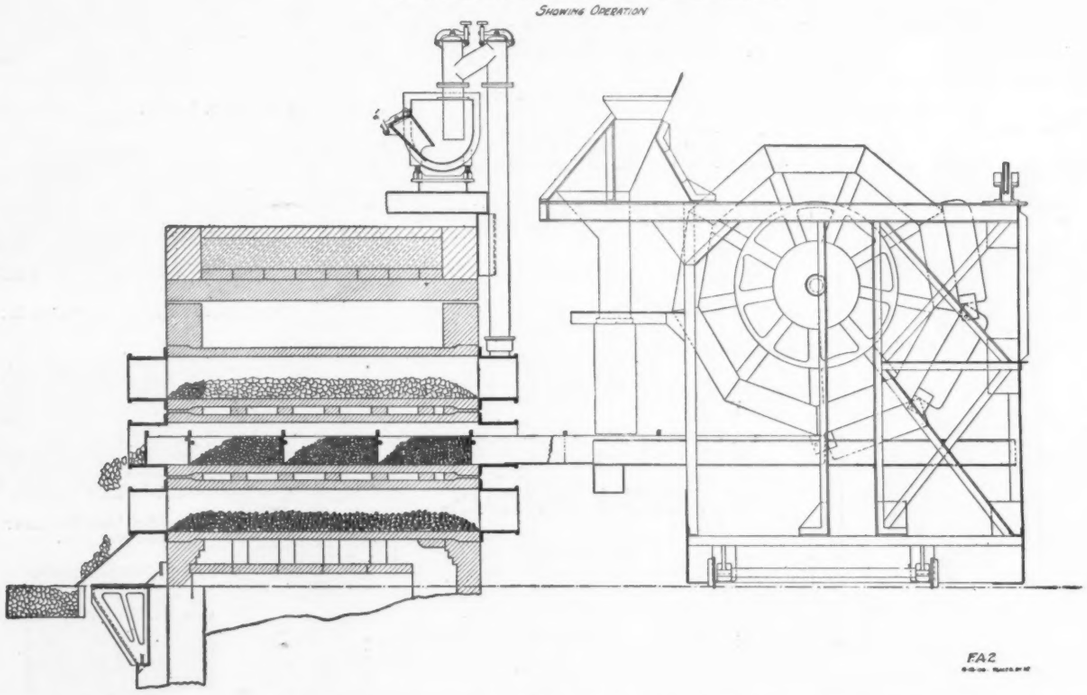

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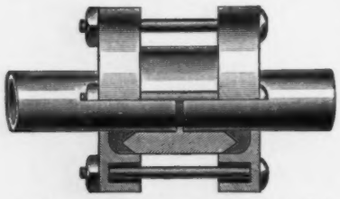
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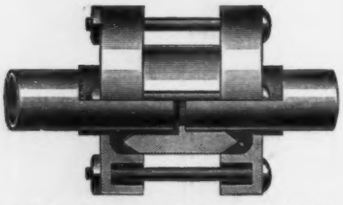
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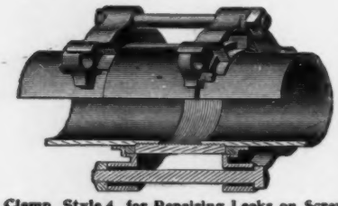
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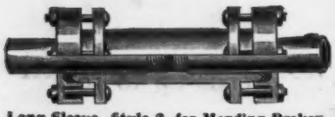
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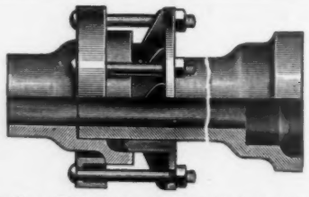
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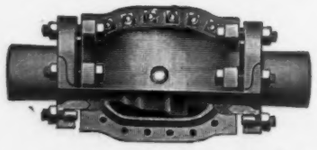
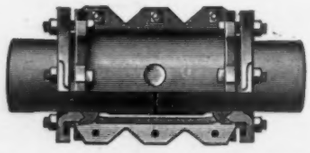
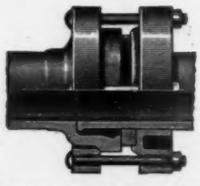

Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.


Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

RICO RICO RICO RICO RICO

What a boost our imitators are giving the "inverted idea."

The joyful part of it all for us is the knowledge that the "idea" is so good that even inferior and impractical lamps cannot discourage the user.

Of course, it will be a little expensive for those who must "go down the line" of imitations before they learn that the "Ramsdell" Inverted Lamps (the "Rico" Brand) are not only the original but the only inverted gas lamps which will give complete and permanent satisfaction.

Why let your customers suffer a loss when you can just as easily give them "Ramsdell" Lamps at the start?

RAMSDELL INVERTED GAS LAMP CO., INC.,
530 BROADWAY, NEW YORK.

RICO RICO RICO RICO RICO

H. M. Byllesby & Company

(Incorporated),

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

HIGH AND LOW PRESSURE DISTRIBUTING SYSTEMS.

AMERICAN TRUST BUILDING,

CHICAGO.

Don't be Misled.

Users of Mueller Brass Goods are Guaranteed Absolute Immunity from all Liability on Account of Patent Suits.

The Glauber company in recent advertisements in trade journals seeks to make business capital of the fact that they have instituted a suit against the H. Mueller Manufacturing Company, alleging "imitating and infringing supplies."

It is not the desire of the H. Mueller Manufacturing Company to try this suit in the public prints or to be drawn into a newspaper controversy, but, in justification to itself and the trade, feels called upon to direct attention of dealers and consumers to the fact that they will be protected.

The H. Mueller Manufacturing Company is financially responsible and has always stood behind its goods with an *Unconditional Guarantee.* It will continue to do so, but in addition at this time wishes to assure the trade and the public absolute immunity from any liability of whatsoever kind arising from the use of its goods because of this or any similar suit.

Whether the action brought possesses merit is a question for the courts to determine. The mere bringing of the suit carries with it no more weight as to its merit than a bald and unsupported statement of an individual. The H. Mueller Manufacturing Company asks the trade and the public to withhold judgment and not be misled by any statements printed in paid advertisements.

We will continue to manufacture the supplies in question and will protect all sellers and users of same.

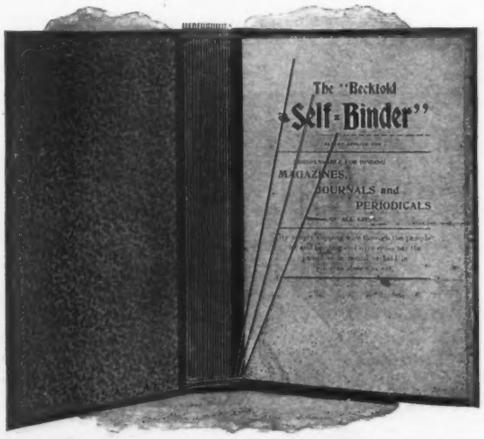
H. MUELLER MANUFACTURING CO.,

Decatur, Illinois, U. S. A. — New York City, U. S. A.

BINDER

FOR THE

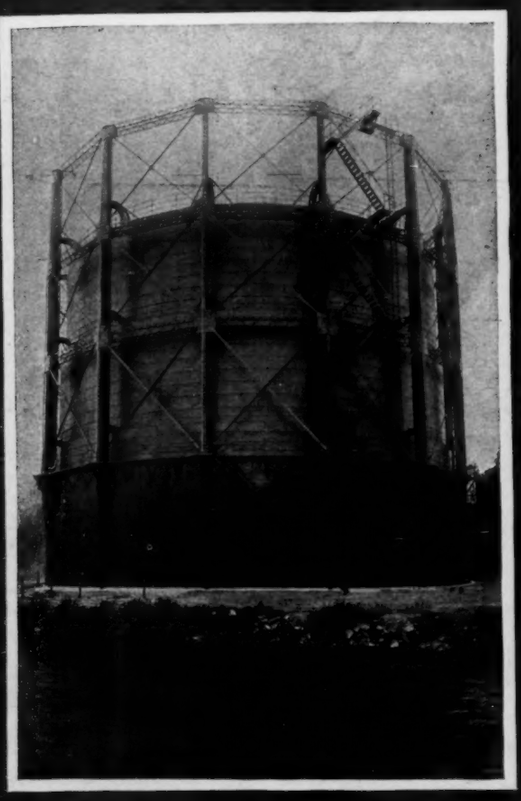
JOURNAL.



PRICE, $1.

FOR SALE BY

A. M. CALLENDER & CO., - 42 Pine St., New York.



ARTHUR R. CRUSE, PRESIDENT.
HENRY W. SCATTERGOOD, VICE PRESIDENT & TREASURER.
FRANK FLAVELL, SECRETARY.

CRUSE-KEMPER COMPANY

PHILADELPHIA OFFICES
1205-6 Stephen Girard Building

WORKS
Ambler, Pa

Manufacturers of

TRIPLE
DOUBLE and
SINGLE-LIFT

Gas Holders

WITH OR WITHOUT
METAL TANKS

Oil and Water Tanks
Purifier Covers
General Plate Metal Work and
Steel Water Towers

PLANS, SPECIFICATIONS AND ESTIMATES
PROMPTLY FURNISHED ON REQUEST

J. S. DeHART, JR., PRESIDENT
A. F. WEHNER, SECRETARY
R. K. WEHNER, TREASURER

ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

BENCH WORK

CHARGING AND
DISCHARGING
MACHINERY

MACKENZIE
EXHAUSTERS

PRIMARY AND
SECONDARY
CONDENSERS
FOR FRESH
OR SALT WATER

ISBELL VALVES
SPECIALS

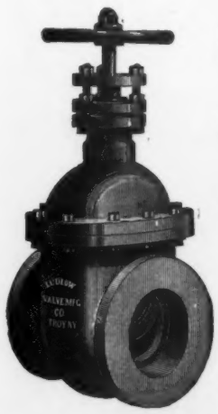
TAR
EXTRACTORS

P.&A. TAR EXTRACTORS
FOR WATER GAS

ROTARY AMMONIA
SCRUBBERS

SHAVING
SCRUBBERS
PURIFIERS
STREET GOVERNORS

MAIN OFFICE AND WORKS
BRIDGE & OGDEN STREETS
NEWARK, N.J.
ESTABLISHED 1865



THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

This cut shows the Hunt Cable Car handling coke (cold) which has been quenched in the main chute.

C. W. HUNT CO.,

FOUNDED 1872.

NEW YORK CITY OFFICE:
45 Broadway, New York.

MAIN OFFICE AND WORKS:
West New Brighton, N. Y.

MANUFACTURERS OF COAL AND COKE HANDLING MACHINERY

AND THEIR APPURTENANCES,

Such as Valves, Screens, etc.; also "Industrial," Automatic and Cable Railways, including cars for unusual conditions.

Bristol's Recording Pressure Gauges

—(ALL RANGES).—

Used the World Over.

Necessary Equipment

Write for Catalogue A.

For Every Gas Plant.

New York: 114 Liberty St.

Chicago: 753 Monadnock Bldg.

The Bristol Co., Waterbury, Conn., U S.A.

ARTHUR E. BOARDMAN, C.E.,

For several years associated with the late CAPTAIN WILLIAM HENRY WHITE,

WILL CONTINUE THE BUSINESS OF

CONSULTING ENGINEER

For Gas, Water and Electric Light Companies, at

No. 41 Wall Street, Room 1707, New York.

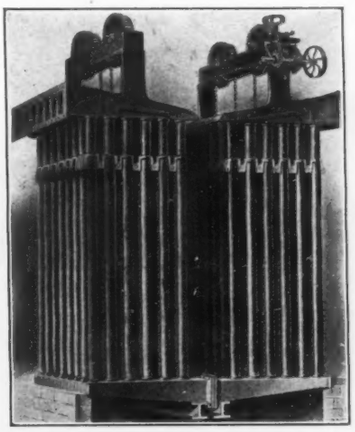
TELEPHONE, 5534 3ROAD.

Modern Machine Shop Construction, Equipment and Management,

By OSCAR E. PERRIGO, M.E.

Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.



HOW MUCH COAL PER 1,000 CU. FT. OF WATER GAS?

If the process of making water gas were theoretically perfect, only 24 lbs. of coal would be consumed per 1,000 cu. ft. of gas generated. As a matter of fact, the actual figures are between 40 and 48 lbs. per 1,000 cu. ft. It is apparent that there is a waste somewhere, and if you will take the trouble to put a thermometer over the stack valve during the "blowing up" period, you will see where the heat goes to. From one-third to one-half of the heat escapes to the atmosphere, either as sensible heat or latent heat of combustion. If use can be found for this heat a great economy could be effected immediately.

We have found such a use. By means of the Green Air Heater 12 per cent. to 15 per cent. of this heat, or more, can be imparted to the air blown to the generator. This will reduce the time for blowing up and increase the temperature of the generator, so that about the same proportion of coal will be saved.

After the gases have passed through the air heater they are still hot enough to use in a Green Fuel Economizer to heat the boiler-feed water up to the evaporative point. In In this way a quarter of the boiler coal can be saved. In connection with a 6-ft. generator an investment of $3,500 in an Air Heater and an Economizer will save from $2,300 to $2,500 per year. This ought to repay you for the trouble of writing us for further information. Ask for Circular "A.G."

THE GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

(Sole builders of the Green Fuel Economizer in this country; we also build Fans and Blowers.)

FOR HOT BATHS,

And for every other Hot Water Need, use the

IMPROVED

HUMPHREY CRESCENT INSTANTANEOUS WATER HEATERS.

Efficient. Compact. Durable. Every Heater Guaranteed.

No. Heaters.	Price.	Gas Supply from Meter.	Heats Gals. per Min. 50° in Temperature.	Height.	Diameter.	Shipping Weight.
Non-Contact.. 2	$40.00	¾ Inch.	2½	34⅝ Inches.	12 Inches.	70 Pounds.
Contact..... 6	29.00	¾ "	3	29⅛ "	12 "	60 "
" 8	23.50	1 "	2½	29½ "	10¼ "	48 "

These prices include Safety Valves and Unions, one Bent Output Spout. For prices of fittings see our complete catalogue, "The Luxury of a Bath."

We will be glad to quote Discounts.

HUMPHREY CO., · · · Kalamazoo, Mich.

The ONLY manufacturers in the world of a complete line of Instantaneous Water Heaters.

LLOYD'S SUBMERSION WASHERS.

Maximum Efficiency,
Minimum Back Pressure,
Complete Safety.

Western Sales Agent
BARTLETT, HAYWARD & CO., Baltimore, Md.

LLOYD CONSTRUCTION CO., Detroit, Mich.

WHY DO GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS BUILT BY

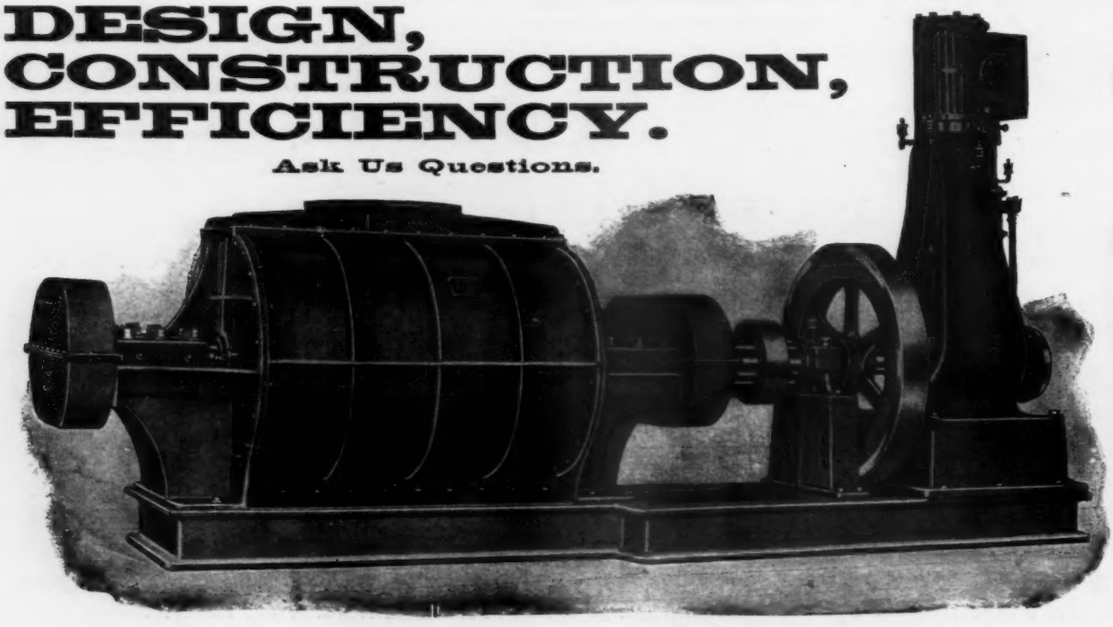
THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

DESIGN, CONSTRUCTION, EFFICIENCY.

Ask Us Questions.



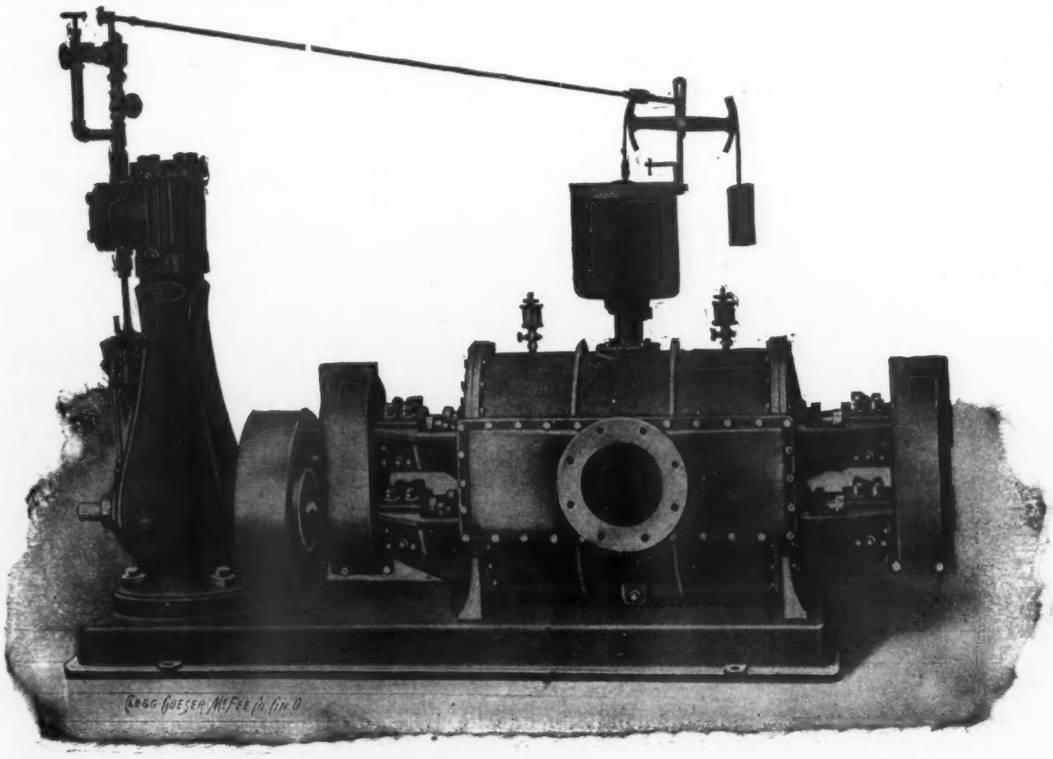
Home Office:
CONNERSVILLE, IND.

Eastern Sales Agent:
HORACE G. COOKE,
95 Liberty Street,
New York City.

Write us about our Improved Stuffing Boxes.

Something Entirely New.

ROOTS' GAS EXHAUSTERS.



Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Bldg.

Electric companies do not expect their arcs to operate without skilled supervision.

The Gas Company that uses Humphrey Arcs and looks after them as faithfully will find its competition worries materially lessened.

NEW YORK CITY:
46 West Broadway.

SAN FRANCISCO:
519 Eddy Street.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

George Ormrod, Pres. & Treas. John D. Ormrod, Supt.
J. G. Eberlein, Secretary.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-Inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

"THE MINER"
Globe
Street and Boulevard
Lamps.
Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.
THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

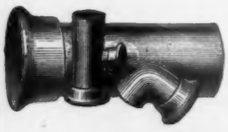
Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 170 Broadway.



CAST IRON WATER AND GAS PIPE,

From Three to Forty-Eight Inches Diameter. Also, all Sizes of

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :

Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 552 E. 135th St., New York City.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

Practical Handbook on
GAS ENGINES,
With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1. For Sale by
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

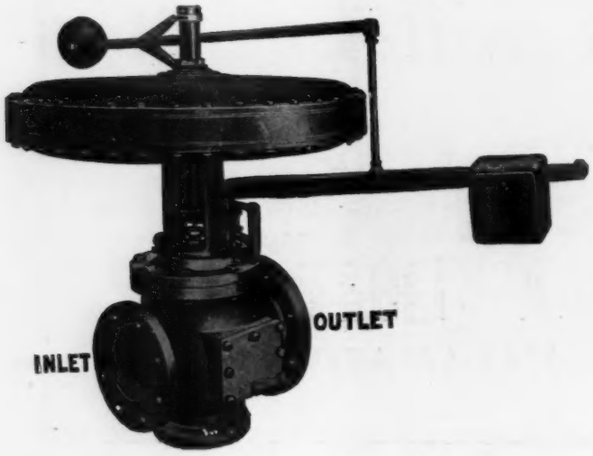
Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by
A. M. Callender & Co., 42 Pine St., N. Y.



THE FULTON GAS PRESSURE GOVERNOR,

WITH AUTOMATIC SAFETY CUTOFF.

For Artificial or Natural Gas.
For District or Service Use.

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

SEND FOR LATEST CATALOG.

THE CHAPLIN-FULTON MFG. CO.,
28-30 PENN AVE., PITTSBURGH, PA.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

FEBRUARY, 1907.

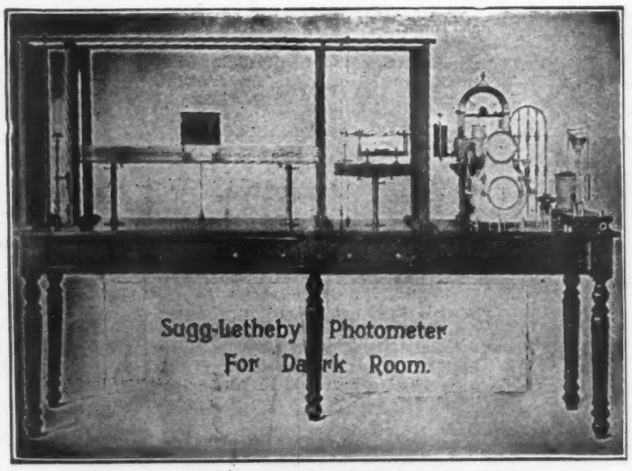
Table No. 1.
FOLLOWING THE MOON.

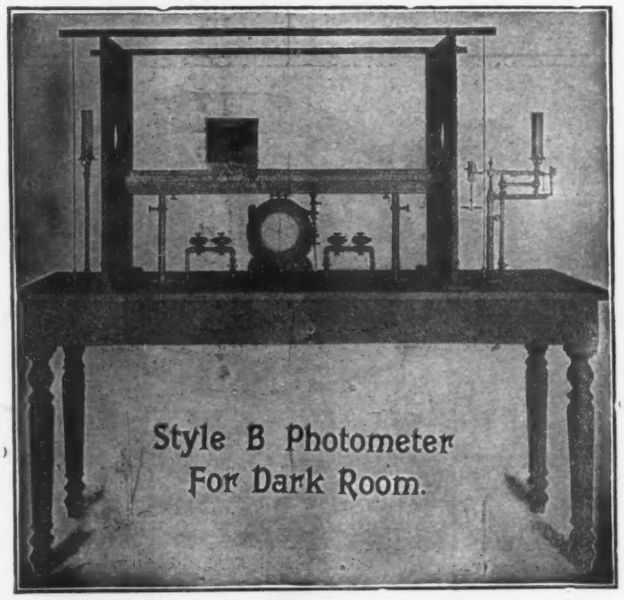
Day of Week.	Date.	Light.	Extinguish.
Fri.	1	5.50 PM	9.30 PM
Sat.	2	5.50	10.30
Sun.	3	5.50	11.40
Mon.	4	5.50	12.50 AM
Tue.	5	5.50 LQ	1.50
Wed.	6	5.50	3.00
Thu.	7	5.50	4.10
Fri.	8	5.50	5.20
Sat.	9	5.50	6.00
Sun	10	6.00	6.00
Mon.	11	6.00	6.00
Tue.	12	6.00 NM	6.00
Wed.	13	6.00	6.00
Thu.	14	6.00	6.00
Fri.	15	6.00	6.00
Sat.	16	6.00	6.00
Sun.	17	10.00	5.50
Mon.	18	11.00	5.50
Tue.	19	12.00 FQ	5.50
Wed.	20	12.50 AM	5.50
Thu.	21	1.50	5.50
Fri.	22	2.40	5.50
Sat.	23	3.30	5.50
Sun.	24	4.10	5.40
Mon.	25	4.50	5.40
Tue.	26	No L.	No L.
Wed.	27	No L FM	No L.
Thu.	28	No L.	No L.

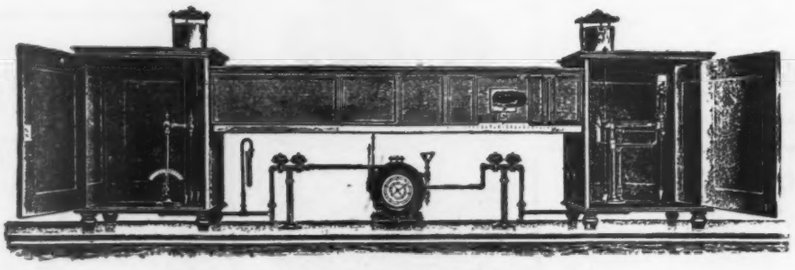
TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

FEBRUARY, 1907.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Light.	Extinguish.
		P. M.	A.M.
Fri.	1	5.05	6.15
Sat.	2	5.05	6.15
Sun.	3	5.05	6.15
Mon.	4	5.05	6.15
Tue.	5	5.10	6.10
Wed.	6	5.10	6.10
Thu.	7	5.10	6.10
Fri.	8	5.10	6.10
Sat.	9	5.10	6.10
Sun.	10	5.10	6.10
Mon.	11	5.10	6.10
Tue.	12	5.20	5.55
Wed.	13	5.20	5.55
Thu.	14	5.20	5.55
Fri.	15	5.20	5.55
Sat.	16	5.20	5.55
Sun.	17	5.20	5.55
Mon.	18	5.20	5.55
Tue.	19	5.30	5.55
Wed.	20	5.30	5.55
Thu.	21	5.30	5.55
Fri.	22	5.30	5.55
Sat.	23	5.30	5.55
Sun.	24	5.30	5.55
Mon.	25	5.30	5.55
Tue.	26	5.30	5.45
Wed.	27	5.30	5.45
Thu.	28	5.30	5.45

TOTAL HOURS DURING 1907.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....

No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

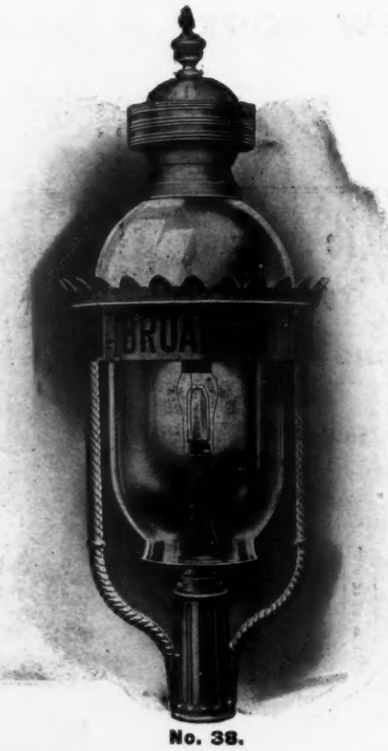
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

INVERTED REFLEX TRADE MARK GAS LIGHT

Succeeds and Excels the Electric Light at One-Quarter the Cost.

THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
Will Not Discolor Fixtures.
Will Not Discolor Ceilings.

THE MANTLE.

Best Welsbach Quality.
Extra Strong and Durable.
Highest Maintained Candle Power.
Rich Mellow Light.

THE GLASSWARE.

Highest Quality Imported.
Special Design Inner Cylinder (No. 317).
Protection from the Falling of Heated Particles.
Increases Candle Power.

Manufactured by

WELSBACH COMPANY.

FACTORIES:

Gloucester, N. J. Chicago, Ill.

Salesrooms in all leading cities of the United States.

WRITE FOR DISCOUNTS.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

LESSEES, OPERATORS AND BUILDERS

OF

GAS WORKS.

LARGEST BUILDERS OF

CARBURETTED WATER GAS PLANT IN THE WORLD.

SOLE BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.

1906 CONTRACTS.

PARTIAL LIST OF PLACES:

New Britain, Conn. (2d contract).
Malden, Mass. (3d contract).
Kirksville, Mo.
St. Johnsbury, Vt.
Memphis, Tenn. (2d contract).
Council Bluffs, Ia. (2d contract).
Seattle, Wash. (2d contract).
Philadelphia, Pa.
Waterbury, Conn.
Manchester, N. H.
Allentown, Pa.
Omaha, Neb.
Muskegon, Mich.
Nazareth, Pa. (2d contract).
Lewistown, Pa.
Greenville, Tex.
New York, Cent. Un. (3d contract).
Jefferson City, Mo.
Peekskill, N. Y. (2d contract).
Waterville, Me.
Washington, D. C. (4th contract).
Lawrence, Mass. (3d contract).
Hampton, Va.
Aurora, Ills. (2d contract).
Milwaukee, Wis.
Syracuse, N. Y. (2d contract).
Davenport, Ia.
S. Brooklyn, N. Y. (3d contract).
Delray, Mich.
Albert Lea, Minn. (2d contract).
Leominster, Mass. (2d contract).
Clinton, Mass.

TOTAL SETS INSTALLED IN 1906, ... 41
TOTAL SETS TO DATE, ... 634
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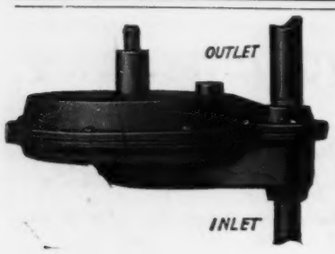

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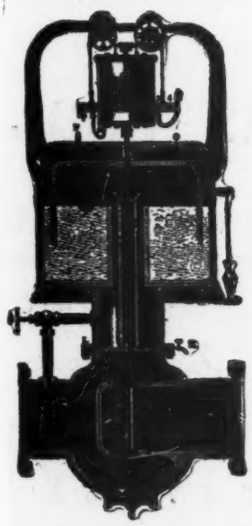

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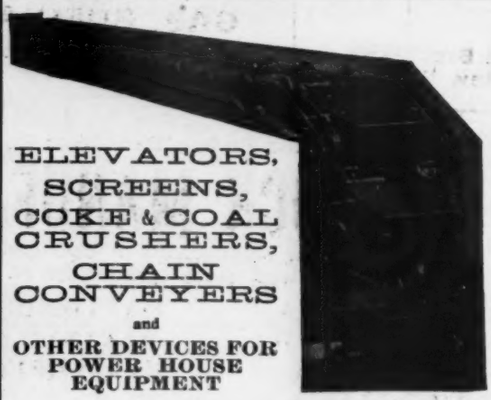

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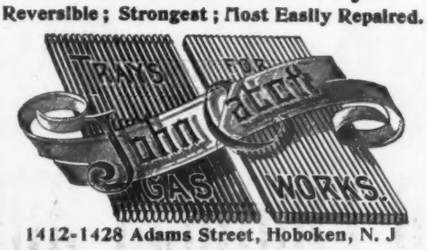

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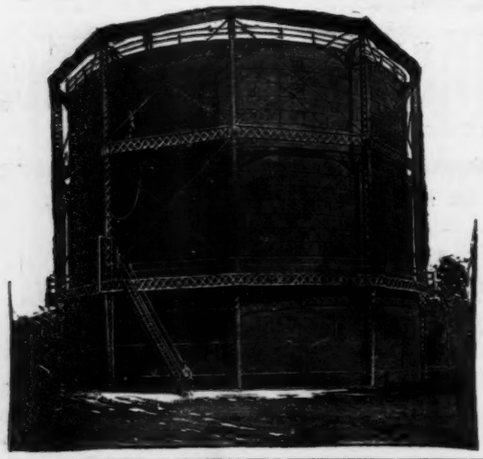

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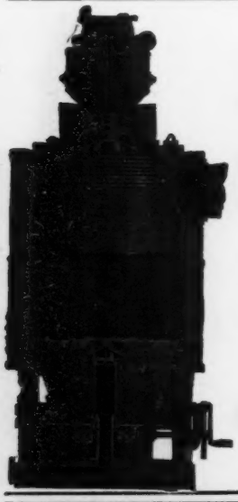

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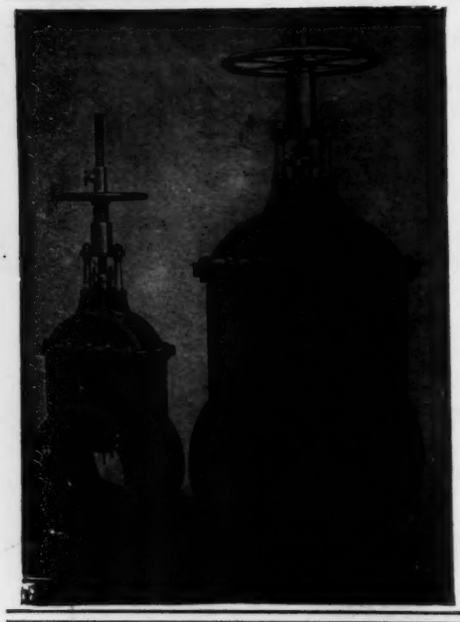

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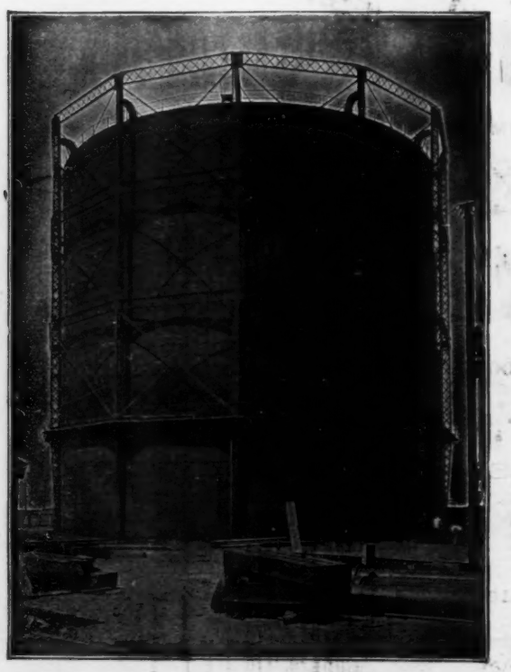

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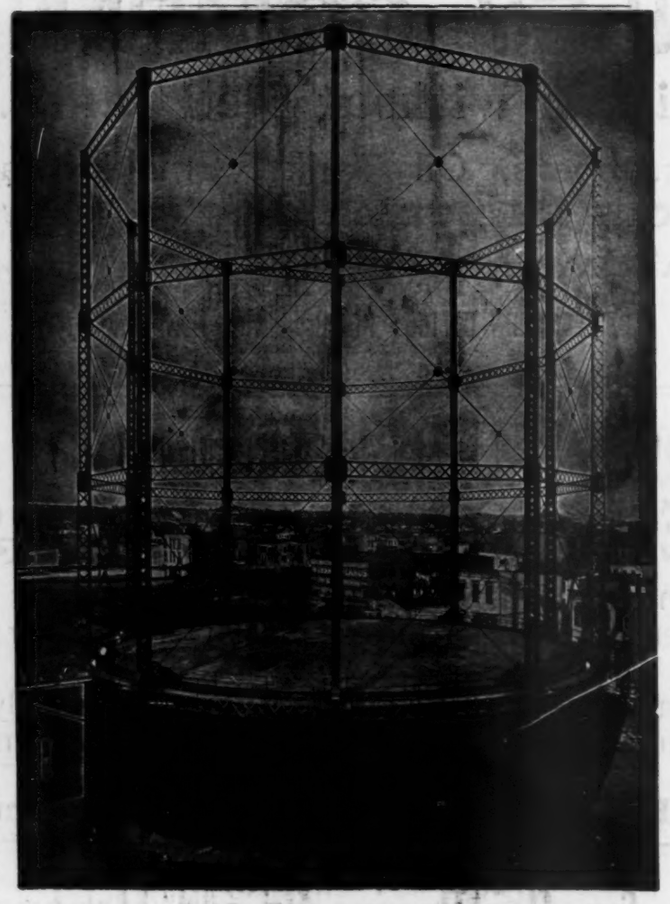

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Will give you longer service, larger service and better service than any other type made. That is the reason gas companies are buying them in car lots.

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We have fitted up over **16,000** Idle, Regular Meters with our

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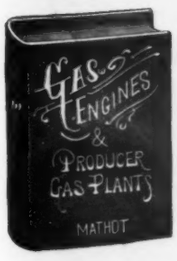

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BEFORE.

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

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